Dissertation on

A STUDY ON DERMATOGLYPHIC PATTERN IN WOMEN WITH BREAST CANCER

Submitted in partial fulfillment for

M.D. DEGREE EXAMINATION

BRANCH- XXIII , ANATOMY

Upgraded Institute of Anatomy

Madras Medical College & Research Institute,

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CHENNAI – 600 032

TAMILNADU

APRIL 2013

CERTIFICATE

This is to certify that this dissertation entitled

"A STUDY ON DERMATOGLYPHIC PATTERN IN WOMEN WITH BREAST CANCER"

is a bonafide record of the research work done by **Dr. G. KARTHIKEYAN**, Post graduate in the Institute of Anatomy, Madras Medical College and Research Institute, Government General Hospital,Chennai-03, in partial fulfillment of the regulations laid down by The Tamil Nadu Dr.M.G.R. Medical University for the award of M.D. Degree Branch XXIII- Anatomy, under my guidance and supervision during the academic year from 2010-2013.

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ACKNOWLEDGEMENT

I wish to express exquisite thankfulness and gratitude to my most respected teacher and guide **Dr. Mrs. Sudha Seshayyan, M.S., Director and Professor**, Institute of Anatomy, Madras Medical College**,** Chennai – 3, for their invaluable guidance, persistent support and quest for perfection which has made this dissertation take its present shape.

I'm thankful to **Dr. V.Kanagasabai, M.D., Dean**, Madras Medical College, Chennai – 3 for permitting me to avail the facilities in this college for performing this study.

My heartfelt thanks to **Dr.I.Jeyaraj**, Additional Professor, **Dr.B.Chezhian, Dr.V.Lokanayaki,** Associate Professors **Dr.M.Vijayalakshmi and Dr.Lakshmi**, **Dr.T.Anitha**, Assistant Professors, Institute of Anatomy, Madras Medical College, Chennai – 3 for their valuable suggestions and encouragement throughout the study.

My gratefulness to **Dr.S. Shanmugha Kumar**,B.Sc., DMRT., MD., HOD, Institute of Radiotherapy, Rajiv Gandhi Govt. General Hospital, Chennai – 3 and Dr.R. Arun Kumar and Dr. S. Moses Arun Singh.

From the bottom of my heart ,I extend my gratitude and heartfelt thankfulness for the immense help by **Mrs. Zareena Nizamuddin.**

I also thank **Dr.Jai Ganesh**, Post graduate in Community Medicine for their help in the completion of this study and Mr. Ravanan, statistician.

I earnestly thank my seniors **Dr.Arunkumar. Dr.Dhanalakshmi, Dr.SathishKumar, Dr.SureshKumar, Dr.Kalai.Anbusudar, Dr.Kanagavalli, Dr.Suganya, Dr.Kausalya** and my helpful juniors **Dr. K.Arumugam, Dr.P.Radhakrishnan, Dr.S.Arrchana** and other members of faculty who have been supportive and encouraging throughout the study.

I also take pleasure in extending my thanks to my colleagues **Mr. Ananth Maharajan, Mr. Arun kumar, Mrs. Anbu malar selvi and Mr. Rajkumar** who assisted me in the completion of this study.

I extend my heartfelt thanks to my colleagues **Dr.V. Dharani, Dr. G.Sreevidya and Dr.K.Savithri** for their constant encouragement and unstinted co-operation.

I'm especially thankful to **Mr. Mathews and Mr Senthil kumar**, technicians, who extended great support for this study and all other **staff**

members including **Mr.Jagadeesan and Mr. Devaraj** for helping me to carry out the study.

I also extend my warm gratitudes to my best friend Dr. Periyasamy. I also take the opportunity to thank my parents for their immense support, care and love.

Above all, I thank the **ALMIGHTY GOD** who has showered His choicest blessings on me and guided me in every step of the dissertation.

INSTITUTIONAL ETHICS COMMITTEE
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CERTIFICATE OF APPROVAL

To
Dr. G. Karthikeyan
PG in MD Anatomy
Madras Medical College, Ch-3

Dear Dr. G. Karthikeyan

The Institutional Ethics Committee of Madras Medical College reviewed and discussed your application for approval of the proposal entitled " A study on dermatoglyphic pattern in women with breast cancer " No. 18022012.

The following members of Ethics Committee were present in the meeting held on 22.02.2012 conducted at Madras Medical College, Chennai -3.

1.	Dr. S.K. Rajan, MD.FRCP.DSc	-- Chairperson
2.	Prof. Pregna. B. Dolia MD Vice Principal , Madras Medical College, Chennai -3	-- Member Secretary
3.	Prof. Md Ali. MD DM Prof & HOD, Dept. of MGE, MMC, Chennai -3	-- Member
4.	Prof Vasanthi MD Prof of Pharmacology, MMC, Ch-3	-- Member
5.	Prof. E. Dhandapani, MD Prof of Internal Medicine, MMC, Ch-3	-- Member
6.	Thiru. S. Govindasamy . BA.BL	-- Lawyer
7.	Tmt. Arnold Soulina MA , MSW	-- Social Scientist

We approve the proposal to be conducted in its presented form

Sd /. Chairman & Other Members

The Institutional Ethics Committee expects to be informed about the progress of the study, any SAE occurring in the course of the study, any changes in the protocol and patient information / informed consent and asks to be provided a copy of the final report

Member Secretary, Ethics Committee

A study on dermatoglyphic pattern in women with breast cancer

BY KARTHIKEYAN 22102402 M.S. ANATOMY

INTRODUCTION

The species of human beings, namely the Homo sapiens are conferred with a protective layer all over the body, the skin. The skin's functions include forming a protective anatomical barrier from external pathogens. In addition to that, the skin is supplied by numerous sensory receptors which provide the function of carrying sensation like touch, cold, vibration, pressure etc. The skin also acts as a thermoregulatory organ, by the function of the sweat glands present in the skin. They are also provided with hair follicles and sebaceous glands, which secrete sebum and provide insulation to the body. It functions as a source of absorption and also for storage and synthesis of certain substances. The skin on the palmar aspect of hands and plantar aspects of soles are specialized. The skin on the palmar aspect is richly supplied by sensory receptors, devoid of hair and hence not supplied by sebaceous glands. In addition to that, every person is also conferred a unique ridge pattern in palm and fingers. These are called the epidermal ridges. They are primarily provided to provide a gripping surface as hands are the gripping tool **(Sir Charles Bell,1833)[10].**

CONTENTS

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The patterns begin to form by 6^{th} to 8^{th} week after conception. These ridges are formed by the alignment of pores of sweat glands in a certain

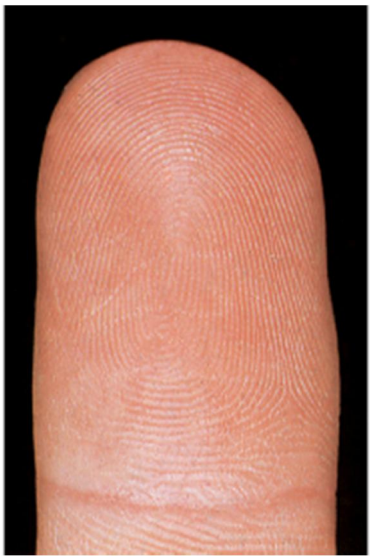


Fig. 1: Palmar aspect of the terminal phalanx to show fingerprint ridges

(From Gray's Anatomy, 39th edition

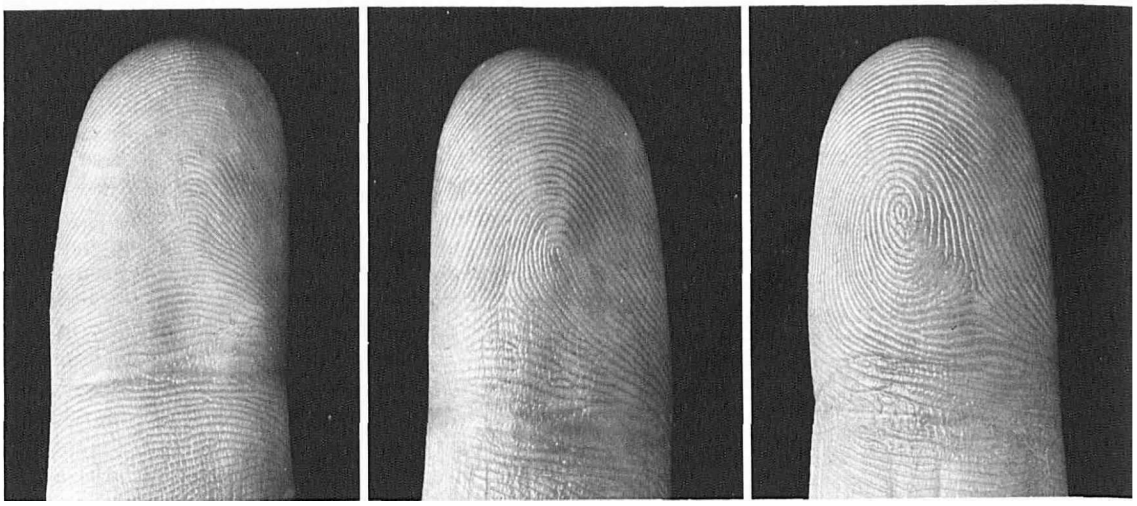


Fig. 2: Photographs of fingertips showing three basic digital patterns, from left to right: arch, loop and whorl

(From Miller.J.R and Giroux.J.)

manner around a central conical eminence, the papilla. The topographical changes in the fetal hand mainly form the ridge pattern. Genetic and environmental factors also influence the formation of dermal patterns. Therefore, any disturbance during the intra uterine growth of fetus will affect normal development of dermal pattern and lead to abnormal configurations. The best example of such prenatal disturbance of the ridge pattern formation is found in the Down's syndrome in which there is retardation affecting the growth of most parts of the body [34].

The scientific study of the pattern of epidermal ridges is known as Dermatoglyphics, which is derived from the Greek word, 'Derma' – skin and 'Glyphics' – meaning curved. **Sir Francis Galton**[70]is considered to be the "Inventor of Dermatoglyphics" and **Cummins14** is considered to be the "Father of Dermatoglyphics". In 1788, **J CA Mayer**[37], was the first to write about basic tenets of finger print analysis and concluded that the dermatoglyphic pattern is never duplicated in 2 individuals[37].

On the basis of his study, Galton[70] classified the patterns into 3 groups, namely, the arches, loops and whorls (Fig.2). Of these , the most commonly seen form is loops, followed by whorls and the least type to be seen is arches. It was first used in India as a means of personal identification

by Sir William Herschel[29], British Chief administration Officer in West Bengal, in 1858. This method was also used in criminology as evidence in the scene of crime. Dr. Henry Faulds[27], Tsukji Hospital, Tokyo,wrote an article in Nature, about picking up finger prints in crime scene. In 1904, Inez Whipple was the first person to carry out a detailed study in non - human prints. Since the pattern of dermatoglyphics reflect the genetic make - up of an individual, these prints act as a guide in certain disease with a proven genetic basis like breast cancer, schizophrenia, Down's syndrome, Klinefelter's syndrome, Alzheimer's disease.

ANATOMY OF BREAST

The breasts are present bilaterally in the pectoral region of both sexes. It is rudimentary in males and forms a secondary sexual feature in females. The breast or mammary gland is a modified sweat gland and lies in the superficial fascia of pectoral region[72].

Breasts are composed of lobes which contain:

1. Network of glandular tissue
2. With branching duct and terminal secretory lobules
3. Connective tissue stroma

The terminal duct lobular unit (Fig.3) is the functional milk secretory component of the breast and pathologically gives rise to malignant lesions within breast[72]. Breast is clinically divided into four quadrants. Among all four quadrants , superolateral (upper and outer) quadrant contains large amount of glandular tissue and is a common site for breast cancer to develop[57]. From this quadrant an " Axillary tail of Spence"[57] often extends into the axilla. Apart from local spread, lymphatic spread is considered as the most common mode of metastasis[3].

BREAST CANCER

Breast cancer is the malignant tumor of the mammary glands. Most commonly, the cancer cells begin in the cells of the lobules of the mammary gland or in ducts. Sometimes, the cancer cells can also begin to proliferate in the stromal tissue which includes the connective tissues of the breast, both fibrous and fatty types.

Breast cancer is the second most common type of cancer seen in India, while cervical cancer holds the first spot. Incidence of cervical cancer is 40%, whereas incidence of breast cancer is 18%. But the number of breast cancer cases are fast increasing. According to Indian Council of

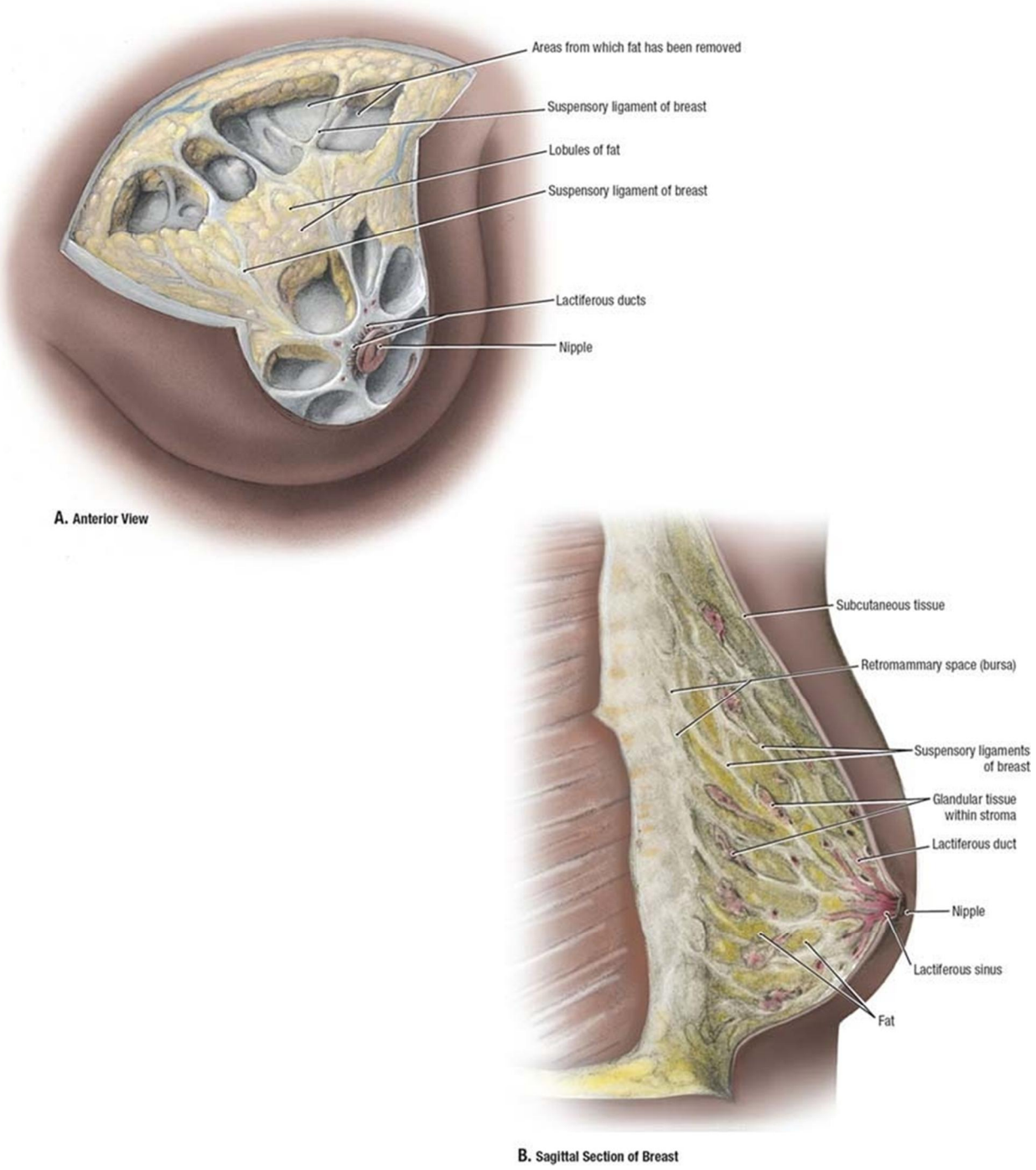


Fig. 3. Anterior view and Sagittal section of breast to show the lobules (From Gray's Anatomy, 40th edition

Medical Reaseach,(ICMR)in a recent data, it is reported that one in 22 of the adolescent age group girls in India are likely to suffer from breast cancer. 75000 new cases are detected every year among Indian women[62]. This figure is more in the western world. The ductal type of carcinoma is the most common type to be seen[41,3].

Incidence

- There is an estimation of 1,00,000-1,25,000 new breast cancer cases in India every year[65].
- Breast cancer is increasing in young (11 percent per decade) and old aged women(16 percent per decade)[65].
- In India the incidence of breast cancer is 28.6/100000 and form 24.7% of all cancers[82].
- In South India the incidence of breast cancer is 22.1 /100000 and form 18.6% of all cancers[82].

Risk factors

Risk factors for breast cancer are elaborated under 3 categories:

Factors Important In Population

1. Age at menarche and menopause – early menarche and late menopause females are more susceptible for breast cancer[3].
2. Parity – nulliparous women are more prone for breast cancer[66].
3. Age at first birth – women more than 35 years of age at first birth[3].
4. Exogenous hormone use or exposure-in particular to oral contraceptive pills and HRT[66.]
5. Alcohol consumption –a high intake of alcohol is associated with an increased risk for developing breast cancer.

Factors Important In Individual Patients

1. Age and gender –The age related incidence of breast cancer continues to increase with advancing age of the female population. Breast cancer is rare in persons younger than 20 years, and in women younger than 30 it constitutes less than 2% of the total cases. The incidence increases to 1 in 93 by age 40,1 in 50 by age 50,1 in 24 by age 60,1 in 14 by age 70,and 1 in 10 by age 80**[66]**.

Gender is also a important risk factor. The incidence of breast cancer in males is less than 1% of the incidence in females[66].

2. Family history
    - First degree relatives of patients with breast cancer have an increased risk for the disease[3].
    - Risk is much higher if affected first degree relatives had premenopausal onset and bilateral breast cancer.
    - An autosomal dominant mode of inheritance is seen in families with multiple affected members, particularly with bilateral and early onset cancer ,the absolute risk in first degree relatives approaching 50%[66].
3. History of previous breast cancer – (Non-invasive or invasive, ipsilateral or contralateral). Risk of developing second breast cancer is about 0.5% to 0.7% in women with previous breast cancer. Women with ductal carcinoma in situ are at an increased risk (4.1%) of developing ipsilateral and contralateral breast cancers after 5 years[66].

Breast Cancer and HereditaryFactors

Genetic factors are estimated to cause 5% to 10% of all breast cancer cases, and may account for 25% of cases in women younger than 30 years.

In 1990, Mary–Clarie King[66] identified a region on the long arm of chromosome 17 (17q21) that contained a cancer susceptibility gene. The gene BRCA 1was finally discovered in 1994 and accounts for up to 40% of familial breast cancer. The gene BRCA1,acts as a tumour suppressor gene which maintain a negative regulation of cell growth and involved in recognition and repair of genetic mutation. Genetic testing of BRCA 1 was difficult because it is a large gene with 24 exons[66].

A protein produced by BRCA 1 gene (breast cancer 1, early onset) is known as breast cancer type 1 susceptibility protein, this protein is also known as RING FINGER protein 53[66]. This protein helps in repairing damaged DNA or destroying the cells with irreversible damage. If this BRCA 1 is itself damaged, it leads to altered protein formation, which in turn leads to an active proliferation of cells without any control. This leads to a cancerous situation. BRCA1 associated genome surveillance complex[77]is a large protein made up of multiple sub units, which is mainly

formed by Breast cancer type 1 susceptibility protein and other suppressor gene, and sensors to detect DNA damage and signal transducers.

One year later (1995) a second susceptibility gene, BRCA 2 was discovered on chromosome 13[45]. Up to 30% of familial breast cancer cases are associated with mutations in BRCA2.In addition to increased breast cancer risk ,woman with mutations in either BRCA 1or BRCA 2 are at increased risk for ovarian cancer[66]. Mutations in either BRCA 1or BRCA 2 usually leads to a risk chance of 85% for breast cancer at the age of 70. The presence of abnormal BRCA 1 stands a risk chance of 55% for ovarian cancer. Presence of abnormal BRCA 2 stands a risk chance for ovarian cancer. Other genes associated with breast cancer are TP53 gene, the ATM gene, PTEN gene. TP53 gene is located on the short arm of chromosome 17; it belongs to tumor suppressor gene family. Persons with mutations of TP53 genes stand a risk chance of 70% for Li – Fraumani syndrome. The ATM gene, located on 11q chromosome is associated with Ataxia telengiectasia. PTEN gene, located in chromosome 10q, is associated with Cowden's disease. The patients of this disease also tend to develop acral keratosis, gastrointestinal polyp, oral pappilloma, multiple facial trichelemmomas and bilateral breast cancer. In Cowden's disease the

incidence of breast cancer is 30 – 50% among women in age group of 50. Maurice et al[81], in their study noticed that women with a family history of breast cancer had a better survival rate when screening was done in a younger age.

Ataxia telengiectasia, Cowden's disease and Li-fraumani syndrome are also associated with increased risk of carcinoma breast.

Pathology

Breast cancer may arise from the epithelium of the duct system anywhere from the nipple end of major lactiferous ducts to the terminal duct unit,which is in the breast lobule[3]. The disease may be entirely in situ or may be invasive cancer.

The degree of differentiation of tumour is usually described by three grades; well differentiated, moderately differentiated and poorly differentiated. Ductal carcinoma is the most common type,but lobular carcinoma occurs in up to 15% cases[66,3].

AIM OF THE STUDY

Breast cancer is the second most common malignant condition after cervical carcinoma in India. The first sign is usually a palpable lump in the breast, which is diagnosed further with other investigative procedures like mammography and final diagnosis is confirmed by histological techniques through biopsy of the specimen. The genetic basis of breast cancer has been studied excessively[77]. BRCA 1 has been excessively implicated in breast cancer.

Dermatoglyphics is a scientific method of study of patterns in finger tips, palms and soles. This pattern is unique to every individual and permanently fixed, with no changes after a set formation. In various studies, the dermatoglyphic pattern variations in patients with genetic diseases like Down's syndrome, schizophrenia, and certain cancer types, like, breast cancer, ovarian cancer has been studied extensively. Therefore, this method of non- invasive technique can be used as a predictor in persons prone for certain diseases when there is significant variations in dermatoglyphic patterns.

This study is aimed at studying the variations in dermatoglyphic patterns in patients with breast cancer in comparison to normal subjects. This study is conducted with the following objectives and aims:

1. To record and study the palmar and finger print patterns in patients with breast cancer and age matched normal subjects taken as controls
2. To compare the dermatoglyphic patterns of cases and controls
3. To assess the variations in patterns of dermatoglyphic features between breast cancer patients and controls and to find out the resultant significance.
4. To assess the usefulness of this technique in acting as a predictor of breast cancer ; the efficacy of this technique as a non-invasive diagnostic tool in identification of breast cancer patients and also to identify persons at risk of breast cancer.

This study is assessed on the basis of the following parameters:

1. Qualitative parameters:
    a. Whorls
    b. Loops

c. Arches

2. Quantitative parameters:

   a. Total finger ridge count (TFRC)

   b. Absolute finger ridge count (AFRC)

   c. a – b ridge count

   d. angles of the palm: atd, dat and adt angles

REVIEW OF LITERATURE

Literature is reviewed in the following topics:

- History of dermatoglyphics
- Dermatoglyphics in medical disorders
- Dermatoglyphics and cancer
- Dermatoglyphics and breast cancer.

HISTORY OF DERMATOGLYPHICS:

Dermatoglyphics is as old as the history of man. It is the study of patterns of dermal ridges in the palmar aspect of hands and digits and plantar aspect of foot and toes[14,71].

Individual characteristic patterns of epidermal ridge are formed during the 3rd or 4th month of fetal life[24.] The size of the pattern increases only parallely but the size remains unchanged. This method was first put to use in India by Sir Willaim Herchel[29.] In 1686, Marcello malphhigi[5], was the first to formally chronicle finger prints observed under microscope. In 1823, John. E. Purkinje[38] was the first to classify the finger ridge pattern and introduce nine print categories. Sir Charles Bell[10], in 1833 studied the structure and functions of hands intrinsically. In 1892, Sir Francis Galton[70],

anthropologist and cousin of Charles Darwin, is considered to be the inventor of dermatoglyphics whereas Cummins is considered to be the father of dermatoglyphics. Sir Francis Galton[70] was the first to introduce practical method of individual finger print identification. He was the one responsible for basic nomenclature to introduce arch, loop and whorl patterns. He scientifically demonstrated permanence of finger prints and also the first to start twin research. Harris Hawthorne Wilder[25] in 1897 was the first American to study dermatoglyphics named A, B, C, D, Triradii points. He was the first to invent main line index, studied thenar and hypothenar eminence, zone II, III and IV. In 1923, Kristine Bonnevie[45] was the first person to start extensive genetic studies.

- **Nehemiah Grew(1684)**[83] lectured in the Royal College of Physicians of London about the interesting markings found on human fingertips. He described them as composed of numerous 'ridges of equal bigness and distance and everywhere running parallel with one another'. He pointed out that, in certain places, 'triangles' and 'ellipticks' were formed and that there were pores, which excreted sweat, situated along the tops of the ridges.
- **G. Bidloo(1685)**[5], described the fingerprints with detailed drawings in his book on Human Anatomy , Anatomia Humani Corporis (Amsterdam : Utrecht Edition 1685).

- **Bidloo and Malphigi(1686)**[5] gave the earliest account of dermatoglyphics in 1685 & 1686 respectively.

- **J.C.A.Mayer(1788)**[37], described about the basic tenets of fingerprint analysis that the arrangement of skin ridge is never duplicated in two patterns, nevertheless, the similarities are closer among some individuals.
- Dermatoglyphics mentioned in the anatomical work of **Mayer and Schorter (1789)**[39] explained the arrangement of ridges and pores.

- **J.E. Purkinje(1823)**[38], first classified systematically the variety of pattern of fingers. He proposed the rules for classification of fingerprints and classified them into nine categories: 1.Transverse curve, 2.Central longititudinal stria, 3.Oblique strip, 4.Oblique loop, 5.Almond whorl, 6.Spiral whorl, 7.Ellipse, 8.Circle and 9.Double whorl.

- **W. J. Herschel(1858)**[29], chief Magistrate of Hooghly district in Bengal, India first used the fingerprints on native contracts to prevent the impersonation of signature.

- **H. Faulds(1880)**[27], discussed fingerprints as a means of personal identification, and the use of printer`s ink as a method for obtaining fingerprints in his article in the Scientific Journal, Nature.

- **Juan Vucetich(1892)**[84] made the first criminal fingerprint identification. He identified a woman named Francis Rojas, who murdered her two sons and cut her own throat in an attempt to place blame on another. Her bloody print was left on a door post, proving her identity as murderer.

- **Sir Francis Galton(1892)**[70] - published a book `Fingerprints' in which he established the individuality and permanence of fingerprints and included the first classification system for fingerprints. According to his calculations, the odds of two individual fingerprints being the same were 1 in 64 billion. Galton identified the characteristics by which fingerprints can be identified. These characteristics (minutia) are still in use today and sometimes referred to as Galton Details.

- **Kristine Bonnievie (1924)**[13] studied the palmar dermatoglyphics of Norwegian criminals in Oslo and her frequency of the patterns was in close agreement with earlier results of Galton in England. She proposed the qualitative genetic method to study the inheritance of

fingerprint characteristics. She also illustrated the embryological process leading to expression of particular pattern.

- **Cummins (1926)[13]** – professor of Anatomy in the Tulane University, was the first person to show that palm and fingerprints could be of use in clinical medicine. He published a book "An introduction to Dermatoglyphics" with the help of Midlo which became an indispensable in dermatoglyphics and got worldwide recognition.

- **Scheimann M.D (1969)[71]** discussed a number of fingerprint features as well as features of dermal ridges on the palm. He observed that loops and whorls were the most common fingerprints and tented types were the most common palmar patterns.

- **JR Ghosh et al(2011)[43]**– they studied the dermatoglyphic pattern in 225 Sunni Muslims of Howrah District, West Bengal. TFRC was higher in right hand (99.16±38.6) compared to the left hand (67.64±20.12) but with regards to AFRC it showed an inverse relationship, the mean AFRC in left hand (98.84±38.87) was higher compared to right hand (68.48±20.15). This study was done within healthy individuals as an anthropological study.

DERMATOGLYPHICS AND DISEASES:

- **Harold Cummins (1936)**[14]was the first person to show the possible use of dermatoglyphics in clinical medicine. He noted characteristic dermatoglyphic features in Mongolism. There is decrease in frequency of whorls and increase in ulnar loops, a single transverse palmar crease, wide atd angle, significant deviation of axial triradii, increased frequency of patterns in hypothenar, second and their third interdigital areas and more common Simian line as compared to non-Mongols.
- **J. B. Ludy (1944)**[40]– showed in some of the clinical cases, hereditary absence of certain ridges.
- **Holt SB and Linstein (1960)**[33] – conducted studies in patients with Turner's syndrome and found an increase by about 10 degrees in comparison to normal subjects.
- **Uchida et al (1962)**[75]– he conducted studies in cases with trisomy 18 and trisomy 21 conditions and found absence of the digital palmar crease, increase in the frequency of arches and increased atd angle and higher levels of axial triradii.
- **T.J.David (1972)**[88] found decrease in a-b ridge count in patients with tuberous sclerosis and also suggested that single gene disorders do not affect the dermatoglyphic patterns. He also did a study on

dermatoglyphics in congenital heart disease and noticed overall increase in incidence of hypothenar pattern with increased atd angle.

- **Chris C Plato et al(1973)[12]**– done their study to assess the peculiar dermatoglyphic features in Down's syndrome.145 male patients and 120 female patients were selected as cases for this study. 108 normal male subjects and 114 normal female subjects were selected as control. The results showed significant difference in subtypes of the C-line terminations in the hypothenar area. Simian lines also showed significant difference between cases and control.
- **Mazakatsu Gotu et al (1977)[46]** – conducted studies in pediatric division in children with different congenital diseases of the heart, and found a statistically significant difference in total finger ridge count in the affected patients and also their mothers. They also suggested that this different pattern can also be inherited from their mothers.
- **Rodewald et al (1980)**[90] found excess of ulnar loops on the fingertips, symmetrical high terminations of the A line, symmetrical ulnar loops on the hypothenar areas, distally placed axial triradii and Sydney lines in carriers of balanced 15;21 translocation.

- **Padma T et al (1980)[56]** – conducted their study in patients with corneal dystrophy. They reported a decrease in the number of ulnar loops accompanied with an increase in the number of whorls in patients when compared to normal subjects taken as controls. On quantitative analysis, they found an increased ridge intensity in thenar, a- b area (area in between base of index and middle finger), b-c area (area in between the base of middle and ring finger), c- d area (area in between the base of ring and little finger) .
- **Robert S Young(1982)[64]**– the physical and dermatoglyphic features obtained from published reports of 128 patients with trisomy 9p syndrome and 27 patients with partial monosomy syndromes were analyzed. Dermal ridge patterns and palmar creases of trisomy 9p patients, which are most helpful as a diagnostic tool, are the presence of zygdacylous or absent palmar digital triradii, complex thenar and inter digital pattern, reduced TFRC, transverse palmar ridge alignment, branchymesophalangy and simian crease. In partial 9p monosomy, the features seen were dolichomesophalangy with accessory flexion creases, elevated TFRC, elevated digital whorl patterns, distal displacement of axial triradius, simian creases and palmar dermal ridge dissociation.

- **Herman J. Weinreb(1985)[28]**– This study was conducted with 50 subjects showing symptoms of senile dementia of Alzheimer's type (SDAT). Their dermatoglyphic patterns were taken. 50 subjects with other neurological diseases were taken. 50 subjects without any symptoms were taken as controls. The dermatoglyphic pattern from both these groups was also taken. The results found that there was a significant increase in ulnar loops in the fingertips of cases accompanied with a decreased percentage of whorls and arches. A dermatoglyphic pattern showing 8 or more ulnar loops were observed in subjects with SDAT (72%) than in normal subjects (26%). Within this, 14 subjects among the cases had ulnar loops in all their fingertips but amongst the controls 4 subjects showed ulnar loops in all their fingertips. In subjects with SDAT, 4^{th} and 5^{th} digit fingertip showed increased frequency distribution of radial loops.
- **Winrub H J(1986)[78]** – conducted their study in patients with Alzheimer's disease. They analyzed the finger prints both qualitatively and quantitatively. The qualitative results found were increased frequency in distribution of digital ulnar loops and also presence of simian creases in both hands. Quantitative results were increased pattern density in hypothenar area.

- **Gupta CM and Tutakna MA (1986)[23]**– they conducted their study in patients with multi bacillary leprosy. They analyzed their finger prints on the quantitative aspects. The findings were statistically significant variation of patterns in the areas of thenar and first inter digital areas and also a concomitant slight increase in distal axial triradii frequency.
- **Suvorova KN et al (1989)[73]** – this study was conducted in 530 dermatoglyphic patterns of fingers and palms. 265 patients with 5 different nosologic forms of hereditary ichthyosis were studied. The study revealed significant difference in the pattern types. And also certain patterns were associated with ichthyosis. Except the X – linked condition, all the other varieties showed an abnormal flexor wrinkle in the ridge skin. Abnormal roughness caused by papillae on the epidermal ridges were seen in epidymolyticichthyosis and obliterated type of dermatoglyphic pattern was seen in lamellar ichthyosis. Thereby, variations in the dermatoglyphic pattern might serve as a guide in differential diagnosis of the various types in this disease.
- **Mglinets V A(1991)[48]**– In this study, patients with preaxial defect were taken as cases and normal subjects were taken as controls. It is found in cases, that a decrease in thumb phalanx length and decrease

in the number of ridge count on one hand was accompanied by a decrease in palmar ridge count between metacarpo phalangeal and thumb flexion crease on the other hand. An inter relationship was also found between anomalous flexion crease and respective joint formation.

- **C. S. Mellor(1992)[9]**– fluctuating asymmetry provides a measure of an organism's capacity to buffer adverse factors that could disturb its development. The fluctuating asymmetry pattern is being used recently to investigate developmental disorders. In this study, 100 schizophrenia patients were taken as cases and normal subjects were taken as control, n =100. It was found that the schizophrenia patients showed significant variations in the total finger ridge counts and also showed extensive fluctuating asymmetry.

- **Godfrey et al (1993)[22]** – studied the relationship of fingertip patterns and palm patterns in fetal growth and development. They found that presence of whorls in the finger tips and a narrower palmar angle are sharp indicators of impairment of fetal growth and development. They also found that presence of whorls in the right hand were

associated with increased blood pressure, a difference in the mean systolic pressure rising for each increase of whorl in the right hand.

- **Mattos-Fiore and Saldanha (1996)**[62] found significant difference in frequencies of the loops in male patients of epilepsy and suggested an epigenetic connection between the embryonic regions I-III and normal physiology of CNS.

- **Ravindranath et al (2003)**[63] – conducted their study in patients with rheumatoid arthritis. They found a significant increase in the presence of partial simian creases, increase in arch patterns and increase in whorl patterns in male patients and female patients respectively.

- **Tabhane MK and Pallikundwar KG (2003)**[74]– conducted their study in patients with vitiligo cases. They analyzed the patterns based on quantitative and qualitative aspects. The qualitative data showed an increased percentage of loops in index finger and also increased frequency of distribution in thumb and index fingers. The quantitative data showed a significant difference in total and absolute finger ridge

count (TFRC and AFRC) in patients compared to controls and also a significant decrease in atd angles in patients.

- **Kumar and Manou (2003)**[86] found the peculiar pattern of palmar dermatoglyphics in patients of Mayer-Rokitansky-Kuster-Hauser syndrome. They found a rare type of hypothenar pattern of open fields with straight ridge pattern on both hands which is classified as type 'O'
- **Sayi Rajaangam et al (2008)**[68] –conducted their study in patients with rheumatoid arthritis. They found a statistical significance in a-b ridge count and also deduced that this feature can be used as a diagnostic tool in both male and female patients with rheumatoid arthritis.
- **Fereshteh Shakibaei et al (2011)**[18]**-** This study was done to bring out difference in finger print traits, both qualitatively and quantitatively. 290 patients with schizophrenia were selected as cases and 290 normal subjects were selected as controls. This study also consisted of investigation of fluctuating asymmetry between cases and controls[51]. Random differences in size between supposedly identical right sided and left sided structures were believed to be an indicator of developmental stability. Mean of both the index finger ridge count in

cases was 15.5±4.3 and in controls was 13.6±6.3. The results analyzed using t- test which showed significant differences. They also found that men with schizophrenia had a higher ridge count for both index fingers than normal men ($p < 0.05$). Secondary line creases in each group were divided to low density (< 5 lines in each finger) and high density (> 5 lines in each finger) and these lines showed no significant differences in t – test analysis.

DERMATOGLYPHICS AND CANCER

- **Julian L. Verbov(1970)[44]–**This study was conducted with unrelated British whites (76 males and 82 females) and the cases comprised of 110 patients with leukemia (68 males and 42 female). A different control group were used to investigate abnormal palmar creases. (80 males and 80 females). The features that were studied were total finger ridge count (TFRC), percentage frequencies of ridge count, configuration in 2^{nd}, 3^{rd} and 4^{th} inter digital areas of the palm, a-b ridge count. The statistical analysis was done by Chi Square test. In males, the difference is highly significant, $p<0.001$ in acute leukemia and significant $p< 0.01$ in chronic leukemia. In acute leukemia, main

difference is between proportion of whorls (41.9% in patients and 27.2% in controls) and ulnar loops (41.7% in patients and 62.6% in controls). In chronic leukemia main difference is between the proportion of radial loops (7.8% in patients and 4.9% in controls) and arches (1.4% in patients and 5.3% in controls)

- **I.C. Fuller (1973)[36] –** This study consisted of recording the dermatoglyphics from patients suffering from diabetes, asthma, schizophrenia or duodenal ulcer and a cancer control group. This study is aimed at bringing together the evidence that dermatoglyphic patterns in cancer patients is different from the remainder groups and also from the mixed British population in general.
- **P R Cohen et al(1989)[54]**, described 2 patients with triple palms and pulmonary tumors and reviewed 77 patients with idiopathic and malignancy associated triple palms reported in the world literature. The majority (94%) of published cases of triple palms occurred in patients with cancer; only 5 patients showed no evidence of an associated malignancy. Triple palms were frequently seen in conjunction with aconthosis nigricans (77% of cases), although they can occur alone. In cancer patients with triple palms alone, the most common underlying neoplasm was pulmonary carcinoma (53% of

cases) whereas patients with both triple palms and aconthosis nigricans frequently had gastric (35% of cases) or pulmonary cancer (11% of cases).

- **Floris MG et al (1990)[19]–** finger and palmar prints of 118 women with breast cancer and of 37 women with cervical carcinoma were studied. Results were compared with two groups of healthy women. The first consisted of aged woman (average 78.94) and second of young women. Only 4 differences out of 10 (40%) were significant between women with breast cancer and young women. One out of 10 differences (10%) was significant in comparison between women with cervical cancer and group of elderly women and 2% in comparison to young women. Increase in whorls and decrease in a-b ridge count was observed between cases and control.
- **R Pavicevic et al(1995)[61]**–This study was carried out in 400 healthy population groups as control and 301 histologically confirmed different types of bronchopulmonary cancer patients. Finger prints were taken using Cummins and Bidloo method, the different qualitative parameters like ulnar loop, radial loop, number of whorls and arches were assessed on the palmar and digital areas. Statistically significant differences were found using Chi square test between

males with planocellular carcinoma and anaplastic micro cellular carcinoma $X^2 = 30.846$, $p < 0.001$ and also with healthy population groups $X^2 = 13.557$, $p < 0.005$. The difference between female patients with adenocarcinoma and the healthy patient groups were statistically significant $X^2 = 21.582$, $p < 0.01$. Hence they hypothesized that since the patterns were statistically different; it is possible that the diseases have a genetic linkage.

- **Venkatesh Elluru(2006)[76]-** This study was done to assess the presence of specific and unique dermatoglyphic patterns in patients with oral leukoplakia and squamous cell carcinoma. In this study, 30 patients with oral leukoplakia, 30 patients with squamous cell carcinoma and 30 normal subjects without any history of tobacco chewing or any oral lesions were taken as controls. The drematoglyphic pattern was collected from all the 3 study groups and dermatoglyphic patterns were analyzed, both quantitatively and qualitatively. The following results were obtained by this study. Increased percentage of loops and arches were evident in cases and an increased percentage of whorls were found in controls ($p < 0.001$). Interdigital areas of cases showed increased percentage of loops than whorls ($p < 0.005$). The conclusion was that the varying pattern

of dermatoglyphics may serve as a guide as a non- invasive tool in identifying patients with leukoplakia and squamous cell carcinoma and also to identify control subjects with increased risk of oral leukoplakia and squamous cell carcinoma.

DERMATOGLYPHICS AND BREAST CANCER

- **MH Seltzer et al(1982)[51] –** conducted their study with finger prints taken from 119 subjects, out of which 34 were histologically proven cases of breast carcinoma and 53 were subjects with high risk for development of breast cancer, 32 normal subjects were taken as controls. The difference in finger print pattern frequencies and index of pattern intensity between cases and controls were significant. 32.4% of histologically confirmed cases of breast cancer had 6 or more whorls but controls had 6 or more whorls in 3.1%. 95% of subjects with 6 or more whorls were either histologically confirmed cases of breast cancer or in the group of high risk for development of breast cancer.
- **CM Huang(1987)[8]**-570 breast cancer patients were taken as cases and 570 age matched normal subjects were taken as controls. The dermatoglyphic patterns from both cases and controls were taken. In

premenopausal women, increased frequencies of ulnar loops were seen in left hand of cases. In postmenstrual women, increased frequencies of radial loops were seen in left hand of cases.

- **Howard R. Bierman et al(1988)[35]–**In this study, dermatoglyphic patterns from 200 women with histologically confirmed breast cancer were taken as cases and 138 women were taken as control group without any history of malignant disease. They found that some of the dermatoglyphic patterns like accidentals, transitional, angled ulnar loops and horizontal ulnar loops were significantly associated with breast cancer. They found another pattern called the angled radial loop also to be significantly associated with breast cancer but with borderline importance. Out of the 200 cases, it was found that the accidental pattern was found in 27 subjects and one or more transitional pattern were found in 58 subjects, one or more horizontal ulnar loops were found in 34 subjects, one or more angled ulnar loops were found in 93 subjects. Among the 138 controls, accidental pattern was found in 2 subjects, one or more transitional pattern found in 21 subjects, horizontal ulnar loops found in 6 subjects. One or more angled ulnar loops were found in 16 subjects.

- **Sakinesh Abbasi et al(2006)[67]** -In this study, finger prints were studied in 616 women in three groups. Out of which 154 were breast cancer patients, 154 women with increased risk for development of breast carcinoma and 308 healthy women with no other co morbid conditions were taken as control. In breast cancer patients (48.7%), 6 or more digital whorls were noticed as compared to control group. The whorls were also found to be more in women with increased risk of breast cancer (47.4%) compared to control group (27.5%). No significant increase of patterns were witnessed between group of breast cancer patients and women with increased risk of breast cancer. Therefore they concluded that since the group with increased risk of breast cancer also showed a significant difference in pattern, it can act as a guide for measures for risk reduction and early therapy.
- **PE Natekar et al(2006)[55] –** The dermatoglyphic patterns in 100 breast cancer patients were taken as cases and 100 age matched normal subjects were taken as controls. It was found that 6 or more loops were found in cases and in statistical analysis in comparison to controls, the p value was found to be significant at 5% ($p < 0.05$). In this study, they also found a negative association between patterns showing 6 or more whorls and breast carcinoma.

- **Fatima M. DeSouza et al (2006)[17]–**In this study, the fluctuating asymmetry of finger ridge patterns were studied between 100 cases of breast cancer and 100 controls. The specific breast cancer predisposing genes are BRCA 1, BRCA2 and p53. BRCA2 is the second breast cancer susceptibility gene which has been mapped to chromosome 13q 12-q 13. The human p53 gene has been located on the short arm of chromosome 17, which is known to be a tumor suppressor gene that can be inactivated by point mutations. Fluctuating asymmetry measures were significantly higher in thumb, in female patients with cancer breast (FA = 2.01). The subtotal ridge count (FA = 2.10) and for palmar atd angle (FA = 2.01) also showed differences.

- **Chintamani et al(2007)[11]-**Their study was conducted on 60 histologically confirmed breast cancer patients as cases and their dermatoglyphic patterns were studied in comparison to finger prints from 60 age matched controls, who had no self or family history of diagnosed breast cancer and the observations were recorded. The qualitative data was analyzed with Chi – Square test and Quantitative

(ridge count and pattern intensity index) data was analyzed with t – test. The findings were, 6 or more whorls in the finger print pattern were statistically significant among cancer patients when compared to controls. The mean ridge count in right hand of cases was 12.4 and in controls 18.4. The standard deviation in cases was 2.33 and that in controls was 4.58, $p < 0.05$. The mean ridge count in left hand of cases was 12.4 and that in controls was 19.6. The standard deviation in cases was 1.62 whereas in controls, it was 4.67, by t- test, the p value < 0.05. The mean pattern intensity index in cases was 12.91 and in controls, 11.33, $p < 0.03$. And with respect to qualitative patterns, the findings of 6 or more digital whorls in comparison to control caused a statistically significant difference, $p < 0.02$. Whorls were commonly observed in right ring finger of cases in comparison to controls, $p < 0.02$. Whorls were commonly observed in right little finger in comparison to controls, $p < 0.01$.

- **N S Sridevi et al(2010)[52]–** They studied the relationship of palmar dermatoglyphic patterns of hands in women with breast cancer or at increased risk for developing breast cancer. 100 histologically confirmed cases of breast cancer were taken as cases and 100 age matched control group were taken for this study. It was found that

difference in the mean value of total finger ridge count and absolute finger ridge count between cases and controls were statistically significant and the mean a-b ridge count in right hand of cases was 36.79±7.51 and in controls, it was 31.40±4.91and for left hand in cases , it was 35.18±5.94 and in controls the value was 29.74±5.53 and the difference in the mean of a-b ridge count between the cases and controls were statistically significant.

EMBRYOLOGY OF DERMATOGLYPHICS

Mulvihill and Smith[80] summed up the formation of dermatoglyphic patterns, which was built on the findings of Cummins, Penrose and Hale. The findings given by them on the embryological basis of dermatoglyphic patterns are consistent till this day. During 6 – 8 weeks after conception, ball like little structures, eleven in number, called the volar pads, make up the contour of developing fetal hand. In 10 to 12 weeks, the volar pads begin to recede. The skin ridges or the finger prints begin to appear, the patterns are formed by alignment of pores of sweat glands. The finger ridges are formed mainly due to surface topography changes in the fetal hand. During the same time, the ridges form in a transverse direction which is towards the line of growth stress[24], 13 weeks after conception, taking the shape of the receding volar pads. By 21st week, finger print patterns are complete.

The patterns are also partly determined by heredity ,environment and accidental influences which leads to tension and stress in the growth of the fetus. In early stages of pregnancy, an intrauterine disturbance, whether hereditary or environmental, affecting the extremities will lead to abnormal dermatoglyphic patterns[7].

Hale[24] was the first person to measure the ridge growth quantitatively and also established that the development of ridges stops at 14th week after fertilization. A technique to study the pattern of surface ridges of the fetus was reported by **Okijima**[53] and **Miller**[49].

Bonnevie K(1929)[45]–They hypothesized that the patterning of finger prints is dependent on the arrangement of the peripheral nerves lying underneath. She described that a triradius and a radial loop develop as a result of a nerve developing on the ulnar side. Similarly, an ulnar loop is formed as a result of a nerve developing on the radial side. They also hypothesized that formation of nerves on both sides leads to a whorl formation.

Abel (1936)[1] – the bursting of the embryonic epidermis may be caused by changes in the pressure of the finger tip. This bursting causes disturbances in the patterns which have already been formed by the volar pads. The formation of the embryonic patterns take place at 3 to 4 months of intrauterine life. Some patterns like central loop, arch or whorl is not usually disturbed, but due to this pressure changes the direction of the lines get distorted, thereby causing changes in the direction. The last pattern to appear is the most common to get distorted.

Bradley M Pattern (1946) [7]– during the fourth month, the epithelium begins to thicken and the lower surface becomes irregular, but in the early stages in the formation of skin, the part of union between epithelium and the connective tissue in the dermis is smooth. By 6th month, the irregularities in the pattern begin to show their appearance on the surface, leading to a unique finger print pattern.

W. Hirsch and JU Schweichel (1973)[30] – he pointed out the specific regularity in the arrangement of nerves and blood vessels underneath the developing smooth epidermis that existed shortly before the glandular folds. The patterns are induced by differential growth of blood vessels and nerve prints and the patterns of ridges are developed after glandular folding, after about 4 months. Aberrations of the patterns in certain cases were noticed where the nervous tissue was found to be damaged in embryological period. This led to a positive co relation between neuro epithelium and formation of finger ridges.

Schauman and Alter (1976)[69]– they hypothesized that besides the influence of blood vessels and nerves, other factors such as insufficient supply of oxygen to the layers , distortions in the formation of basal layer of the epithelium and variations in the keratinization have a positive influence

on the epidermal ridge patterns. Also, the external environmental factors like pressure on the volar pads and the finger movement of the fetus leads to formation and subsequent changing of finger ridge patterns.

William J Babler (1978)[2]–the epidermal ridges begin to first appear as localized cellular proliferations at or around 10 – 11 weeks of gestation. The proliferations turn into shallow corrugations which project into the superficial layer of the dermis. The number of ridges keeps increasing between or adjacent to existing ridges and the set unique patterns begin to form at this period of primary ridge formation. At about 14 weeks, the secondary ridges formation starts along the apex of the formed primary ridges at regular interval. Around the same time, the epidermal ridges also form on the volar surfaces. The primary and secondary ridges first begin to appear as smooth surfaces and then become corrugated. The dermal papillae, forming the characteristic patterns are formed. He also suggested a positive co relation between ossification between distal phalanx and the resultant patterns that are formed.

Munger BL and Moore SJ (1989)[50] – the onset and cessation of the formation of the dermal ridges are controlled by the developing afferent nerve fibres, which controls the special orientation of the dermal ridges. This

shows that the nerve fibres are developed prior to formation of dermal ridges.

DERMATOGLYPHICS AND GENETICS:

Wilder HH and Francis Galton (1902)[25,70] – they were the first to study the hereditary influence on the development of dermal ridges, thereby showing the genetic basis of the development of finger prints.

Bonnevie K.(1924)[45] – the inheritance in case of a double cored pattern of finger print is due to a dominant gene. They considered the dominant pattern to be elliptical.

MATERIALS AND METHODS

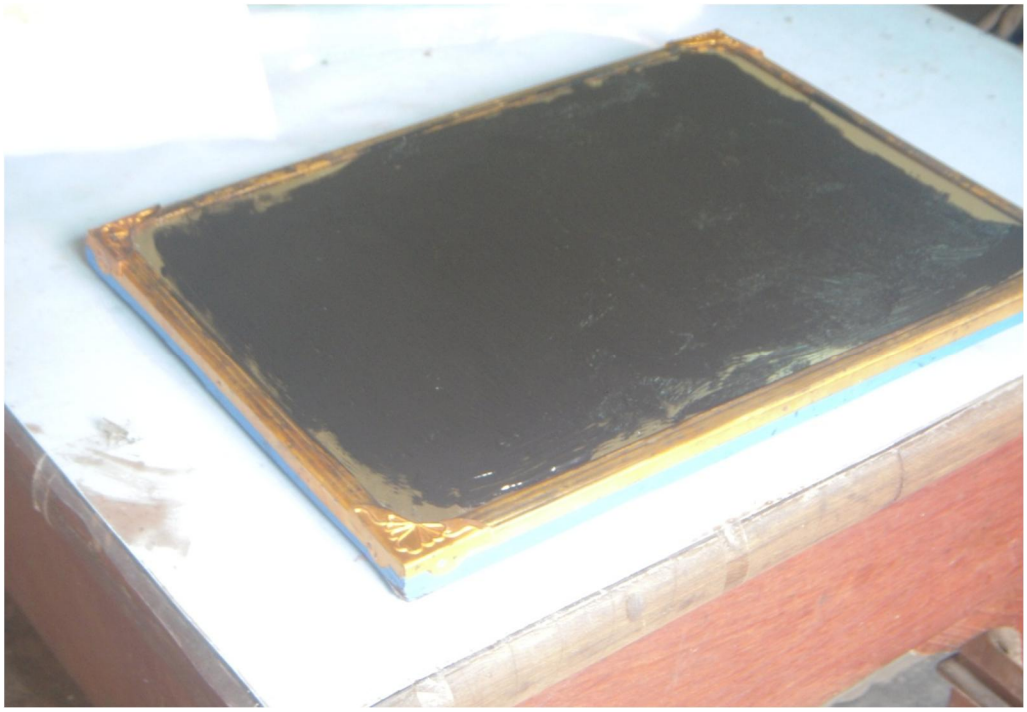
MATERIALS:

The study was conducted at the Institute of Anatomy, Madras Medical College. 100 histologically confirmed patients of breast cancer were taken for the study.The cases were obtained from patients coming for treatment in Institute of Radiotherapy and Dept. of Surgery, Rajiv Gandhi Govt. General Hospital after due permission in the patient consent form. The cases of age group 35 – 60 were chosen for the study. The control subjects were randomly selected among women of similar age group, in and around Chennai, after getting approval in the consent form. Subjects with other clinical conditions like diabetes, hypertension, coronary artery disease, asthma and skin disease were excluded from the study. The number of control subjects taken for the study was 100. The consent was received from both the cases and control after proper explanation of the study purpose.

METHODOLOGY:

Many methods are employed in dermatoglyphic study. The dermatoglyphic patterns remain unchanged from birth and are under genetic control. Gouard Bidloo[4] gave an account of detailed drawings of

Pic 1. Ink used for taking print



Pic 2: Glass slab inked for taking print

finger prints. Some of the methods employed are the standard ink method, inkless method, transparent adhesive method and photographic method.

Standard ink method was first used by Cummins and Bidloo[13]. The same method of ink method was employed in this study.

The materials used in this study were:

1. White paper
2. Sponge rubber
3. Black duplicating ink, (Bombay, Kores)(pic.1)
4. Slab for metal inking or glass (pic 2)
5. Scale
6. Pencil
7. Magnifying lens
8. Needle used for counting of ridges.
9. Protractor for measurement of angle.

Pic. 3: Inked hand placed on white paper for taking prints.

Steps taken in recording the finger ridge patterns:

1. Before starting the procedure, the hands of the cases and controls were thoroughly cleaned with soap and dried completely.
2. The palm and the palmar surface of the finger were then fully dabbed with black duplicating ink. Care to be taken to apply the optimal quantity of ink.
3. Then the ink is uniformly spread over the palm and fingers including the hollow of the palm.
4. Then the uniformity of the ink is thoroughly examined, if certain areas are left out, ink is spread into that area using cotton balls.
5. Firstly, the right hand is pressed from proximal to distal aspect, starting at inter metacarpal groove onto the root of the fingers and also on the thenar and hypothenar areas on the dorsal side. Then, the hand is lifted from the paper from distal to proximal aspect. Rolling of the fingers is done to record the finger prints from radial to ulnar side. (pic 3)
6. The same procedure is repeated on the left side.
7. The sheets are immediately encoded with name, age and sex for case and control groups.

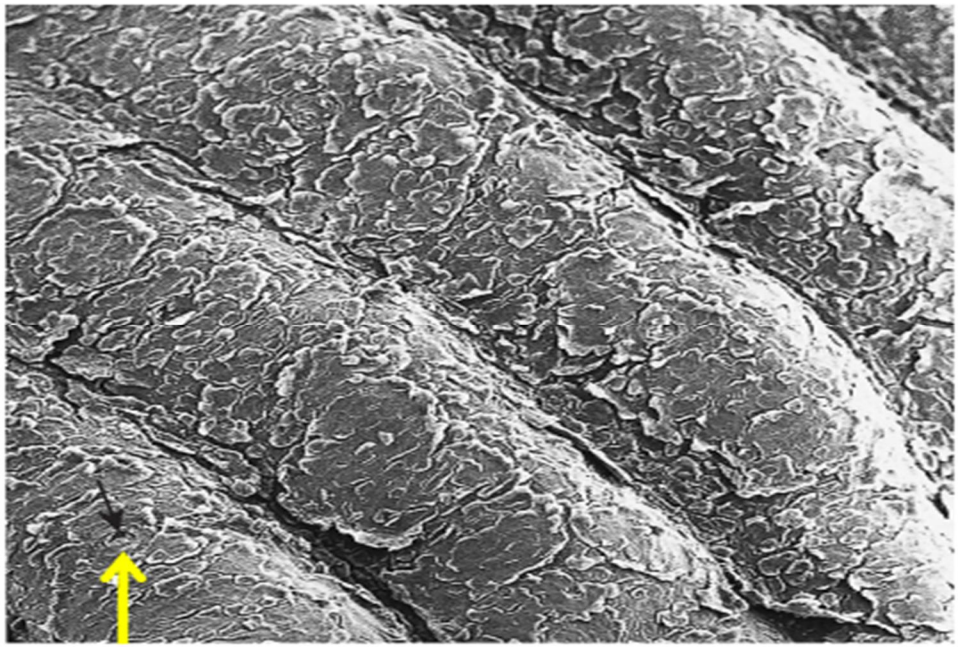


Fig. 4 : Scanning electron micrograph of volar surface of human digit showing papillary ridges, with opening of sweat duct (arrows)

(From Gray's Anatomy, 40th edition)

8. The prints are then subjected to detailed dermatoglyphic analysis
9. The analysis is then done with magnifying hand lens
10. The ridge counting is done with a sharp needle.

PATTERN STUDY (MORPHOLOGY)

Minutiae: (Fig.4)

This is intrinsic detailing about individual epidermal ridges. This is unique to every individual and highly variable in character. Because of its variable and unique tendency it is useful in personal identification.

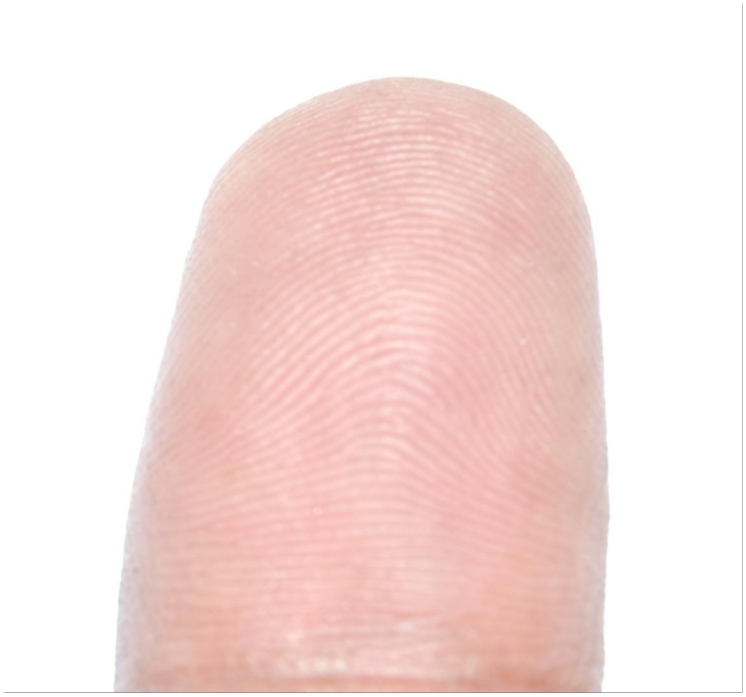
Pattern configuration

Fingers-pattern configuration	**Palm-pattern configuration**
It implies the pattern configuration in fingertip, patterns in middle and proximal phalanges.	It implies the pattern configuration in thenar, hypothenar and interdigital area.
It includes dermatoglyphic landmarks like digital triradius, core and radiants	It includes dermatoglyphic landmarks like a-b ridge count, atd angle and axial triradius

ARCHES

Fig.5. Types Of Arches .

(From Clinical Significance And Genetics Of Epidermal Ridges-A Review Of Dermatoglyphics, Julian Verbov MB)



Pic.4: Volar aspect of fingertip showing Arch pattern

Pic.5: Arch pattern of fingertip from palmprint

Galton[70] classified fingertip patterns into 3 types:

- Arches – about 5%
- Loops – majority, 55 – 65%
- Whorls – 30 -35%

Henry ER[26] added one more group called the composites referring to more complex patterns.

QUALITATIVE DIFFERENTIATION OF EPIDERMAL RIDGES:

ARCHES: (Fig.5, pic.4,5)

These refer to parallel and simple curved epidermal ridges. The direction is proximally concave, based on the curvature, classified into low arch and high arch.

They are broadly classified into2 types:

Simple arch: (Fig 5)

In this pattern, the epidermal ridges cross the fingertip area from one side to the other without any recurving. They do not meet at any point. This is not a true pattern. Therefore no tri radius is evident in simple arch.

Tented Arch: (Fig 5)

The epidermal ridges meet at a point; therefore their smooth curvature is interrupted. The ridges meet at one point, thereby forming a triradius. The distal radiant of this radiant is directed towards the finger tip. Other ridges run over this distal radiant and thereby form the tented arch pattern.

Loop: (Fig 6, Pic.6,7)

Among the 3 types, this is the most common pattern seen. It is formed by a series of epidermal ridges that enter and exit the pattern area on the same side. Based on this, it is classified as ulnar loop (Lu), if the ridges enter and leave on the ulnar margin of the finger and radial loop (Lr) if the ridges enter and exit on the radial margin of the finger. Generally one triradius is observed in this pattern, and is seen on the same side as the crossing of the loop.

Whorls: (Fig.7,8,9,10,11) (Pic.8,9)

Henry defined the whorl pattern as the epidermal configuration in which the ridges encircles a central core and the more complex patterns among this are called as “composites”

LOOPS

Composite loop

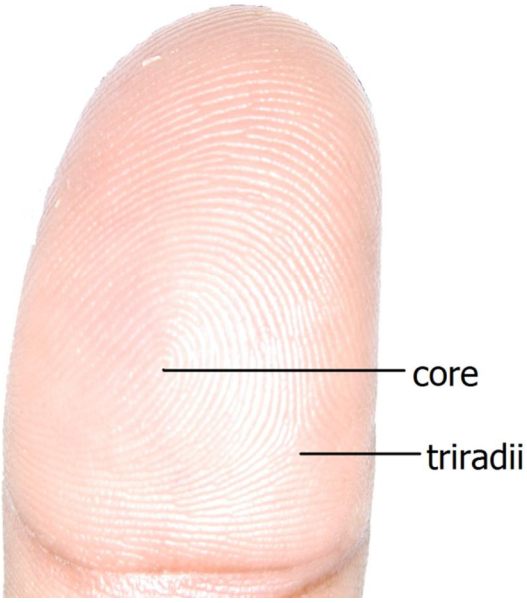
Twinned loop

Ulnar loop

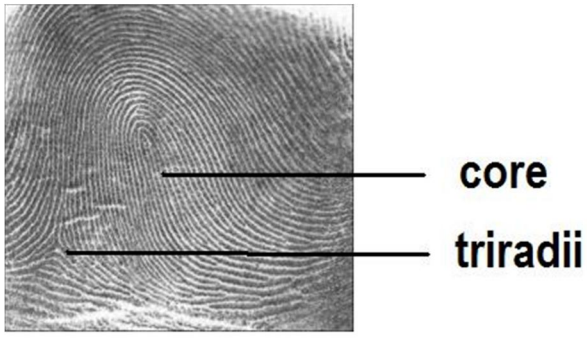
radial loop

Fig.6. Different Types of Loops .

(From Clinical Significance And Genetics Of Epidermal Ridges-A Review Of Dermatoglyphics Julian Verbov MB)



Pic.6 : Volar aspect of thumb showing loop pattern



Pic.7 : Loop pattern of fingertip from palm print

Galton classified this pattern as the type having 2 or more than 2 triradii.

The types of whorls are:

- Concentric whorls (Wc): arranged as concentric rings around a central core.
- Spiral whorls (Ws): arranged as spiral ridges around a central core, directed clock – wise or anti clockwise. (Fig. 7)
- Mixed whorls (Wmix): it contains both concentric and spiral whorl patterns.
- Central pocket whorl (Wcp): within a loop, smaller whorls are identified in certain cases. Based on the opening pattern of the loop, these whorls are also classified into ulnar central pocket whorls and radial central pocket whorls. (Fig .8)
- Lateral pocket whorl (Wlp) or twin loop whorl (Wtl):this pattern contains 2 triradii. From the central core, the radiants project out in the same direction. And in the twin loop whorl, the radiants project out in the opposite margin of the finger. (Fig .11)

Types of Whorls

Fig.7. Spiral whorl

Fig. 8. Central pocket whorl

Fig. 9. Accidental whorl

(From Clinical Significance And Genetics Of Epidermal Ridges-A Review Of Dermatoglyphics Julian Verbov MB)

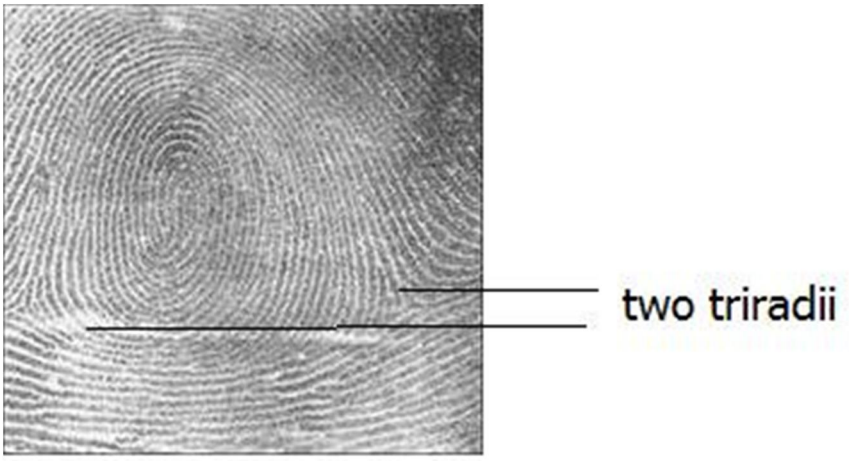
Types of Whorls

Fig.10. Symmetrical whorl

Fig.11. Double loop Whorl

(From Clinical Significance And Genetics Of Epidermal Ridges-A Review Of Dermatoglyphics Julian Verbov MB)

Pic. 8. Volar aspect of fingertip showing whorl pattern



Pic.9. Whorl pattern of fingertip from palm print

- Accidentals (Wacc): they cannot be classified into any of the patterns mentioned, but are a mixture of many patterns.

  (Fig .9)

Quantitative Differentiation of Epidermal Ridges:

Intensity of patterns:

This refers to the variation in patterns that can be encountered in a ridge configuration. It can be deduced by adding the total number of triradii. Based on the variation of the patterns, the intensity of the patterns can be numbered from 0 to 3in fingertip. In the palm, it is deduced by adding the total number of triradii present in palm.

Ridge count:

This indicates the pattern size. A straight line is drawn between the triradial point and the core and the ridges within this area are counted excluding the ridge containing the triradial point and core. In the case of whorl with 2 triradii, line is drawn from the triradial point to the nearest point of the core. The countings are specified as radial and ulnar. The methodology of counting is from the little finger to thumb in left hand and

thumb to little finger in right hand. Simple arch has count 0 because of absence of triradii and tented arch has score 0, because of absence of core.

The ridge count is classified into:

- Total finger ridge count (TFRC)
- Absolute finger ridge count (AFRC)

Total finger ridge count:

It is the count of ridge pattern of all ten digits where the pattern with the maximum count is taken into account if more than one pattern is encountered. It depicts the size of the pattern.

Absolute finger ridge count:

It is the count of ridge patterns of all ten digits where all the patterns are taken into account. This depicts pattern size and intensity.

Total score of all the ten digits averages to about 127 in females and 145 in males. This sum has been demonstrated to be entirely under genetic control (Gibbs R C 1967)[21]

Fingertip – Dermatoglyphic Landmarks:

Triradius:

The confluence of 3 ridges leads to the formation of a triradii. The point where the 3 ridges meet is known as triradius point. Sometimes, the ridges fail to meet, in that case the triradius point is represented by abrupt ridge ending, dot like and very short ridge called Island or may be represented by a point which lies on the ridge at a particular point which lies near the centre of the divergence of the 3 independent innermostridges. If this type of triradius is seen, then the point is named as “extra limital”. This type is commonly seen in hypothenar area of the palm

Core: (Pic.10)

This point represents the approximate point of centre of palm. It shows varying shapes. In the process of ridge counting, the counting is done from the point of core.

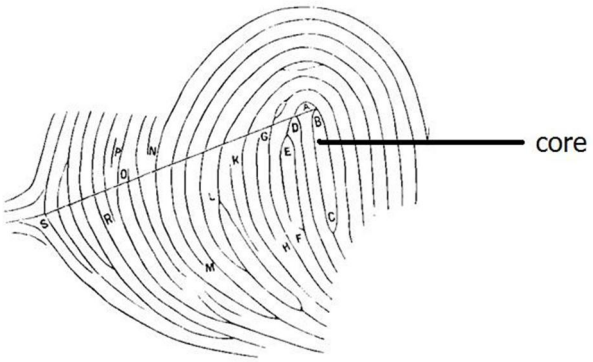


Fig.10. Core

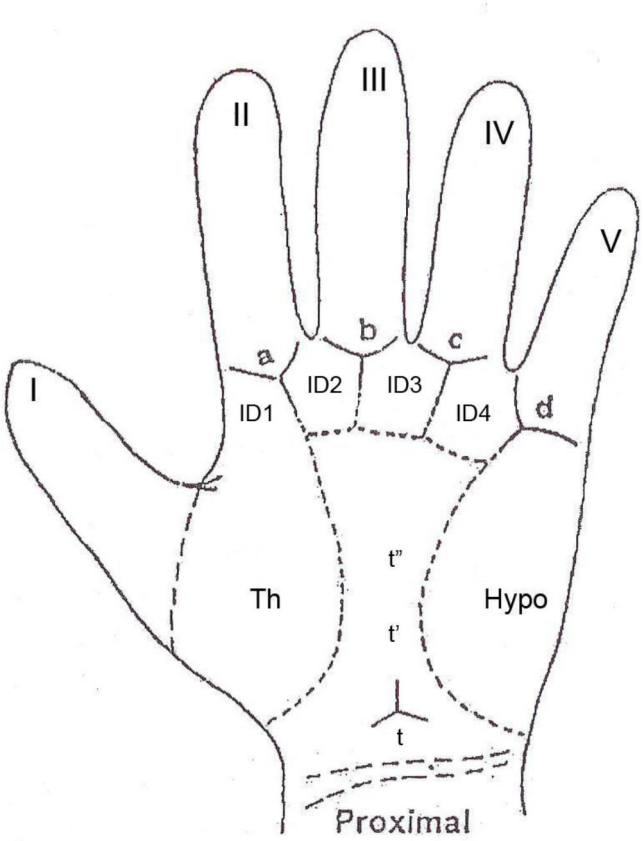


Fig.11. Palmar pattern configuration

Radiants:

Radiants are finger ridges that diverge from the triradius point. Thereby, they enclose the areas of pattern.

Palmar configurations: (Pic.11)

In the process of dermatoglyphic analysis, the area of palm is being divided into:

1. Thenar area
2. Hypothenar area
3. Inter digital areas.

Thenararea: (Pic.11)

This area is located in the thenar region, which corresponds to the base of the thumb.

Hypothenar area: (Pic.11)

Hypothenar area is near the ulnar border of the palm.

Interdigitalareas: (Pic.11)

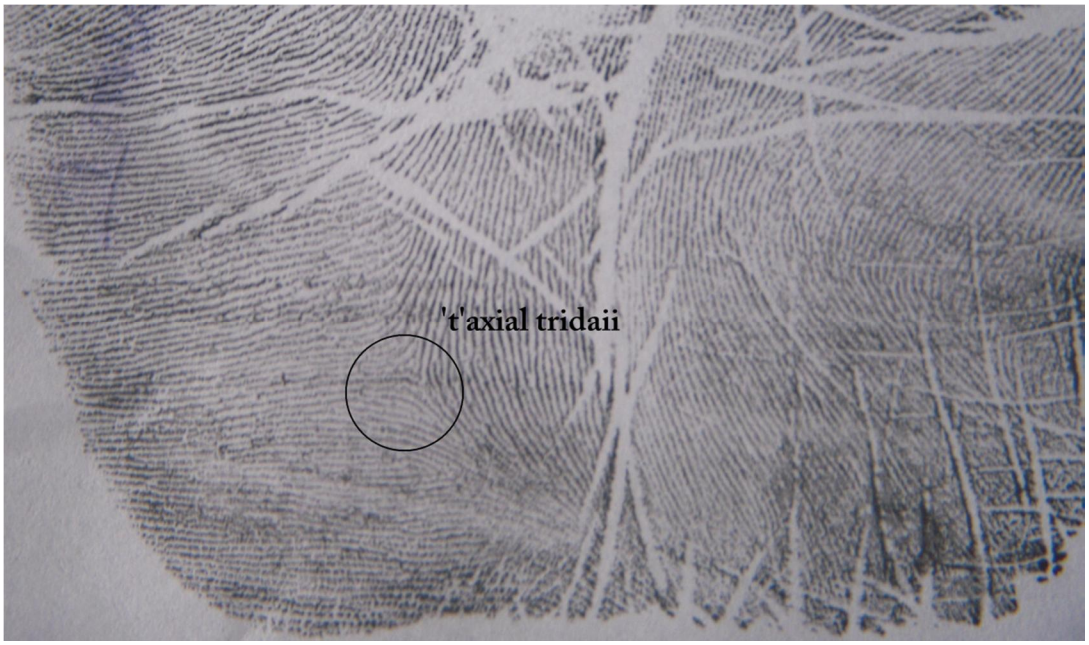
These areas are found in the area of distal aspect of the palm, in the region of the metacarpal heads. Each area is bordered laterally by digital triradii. This digital triradii is located proximal to the base of digits from II to IV.

These digital triradii are labeled as a, b, c and d, where ‘a’ is the area located proximal to the base of II digit and ‘b’ is the area located proximal to the base of III digit, ‘c’ is the area located proximal to the base of IV digit and ‘d’ is the area located proximal to the base of IV digit.

The interdigital (ID) areas are represented by:

- ID 1 – between thenar and ‘a’
- ID 2 – between ‘a’ and ‘b’
- ID 3 – between ‘b’ and ‘c’
- ID 4 – between ‘c’ and ‘d’

In case of absence of digital triradius, midpoint of the base of the corresponding digits can be used to demarcate the interdigital (ID) areas.



Pic. 12: Axial triradii (‘t’ position) in the palmar dermatoglyphic

Axial Triradius (T): (Pic.12)

The triradii which are present in close proximity to the palmar axis is known as axial triradii.

t – the triradii which are situated close to the wrist in the palmar axis

t´– situated near the centre of the palm, close to the palmar axis

t´´ – situated between t and t´. This is also named as intermediate triradius.

Palm – Dermatoglyphic Landmarks:

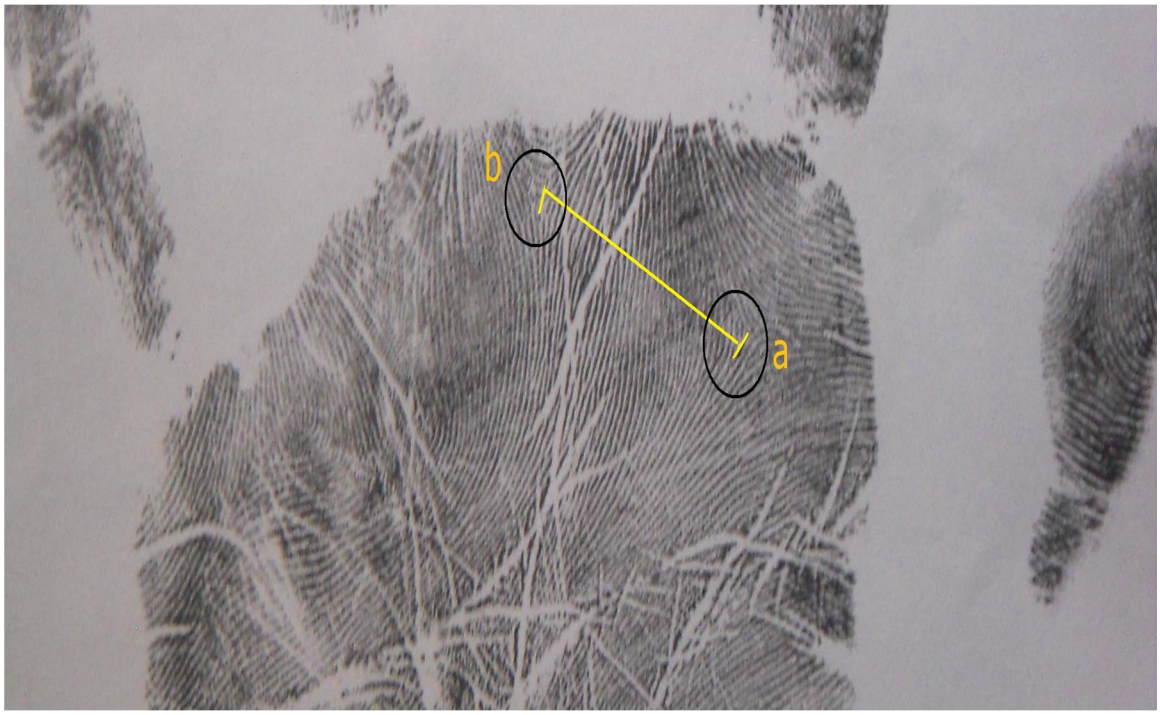
a – b ridge count: (Pic.13)

Number of ridges situated between point 'a' and 'b'.

Angles of the Palm: (Pic 14,15)

atd angle: (Pic.14)

This shows the extent of distal displacement of axial triradius. If the axial triradius is located more distally, it leads to an increase in the atd angle. This angle is used extensively in dermatoglyphic studies. This was first introduced by Penrose[58].



Pic.13. Calculating ab Ridge Count

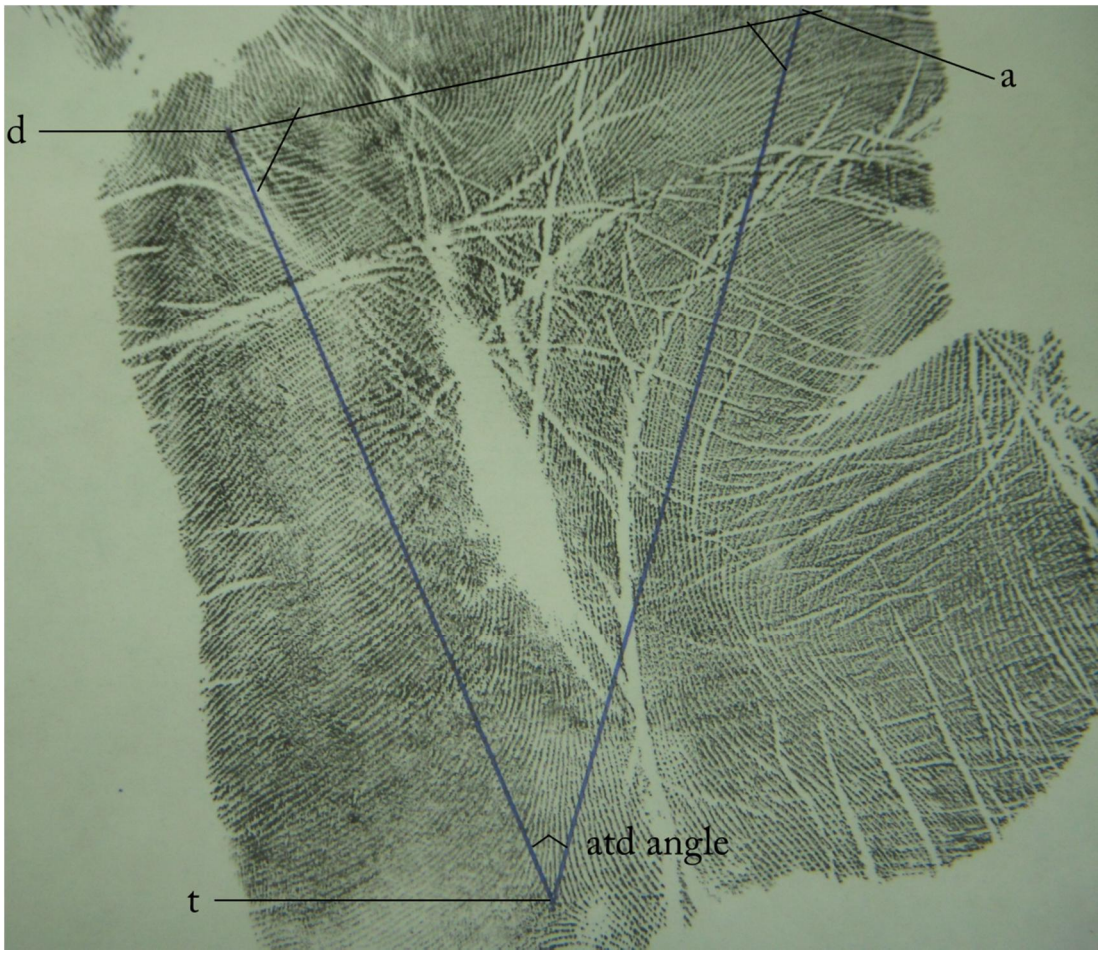
A line is drawn from the digital triradius ‘a’ to the axial triradius‘t’, then from ‘t’ to digital triradii ‘d’. The disadvantage of this method is that, as age progresses ‘t’ is displaced distally, thereby leading to alterations in atd angle and the amount of pressure applied leads to alterations in atd angle.

adt angle: (Pic.14)

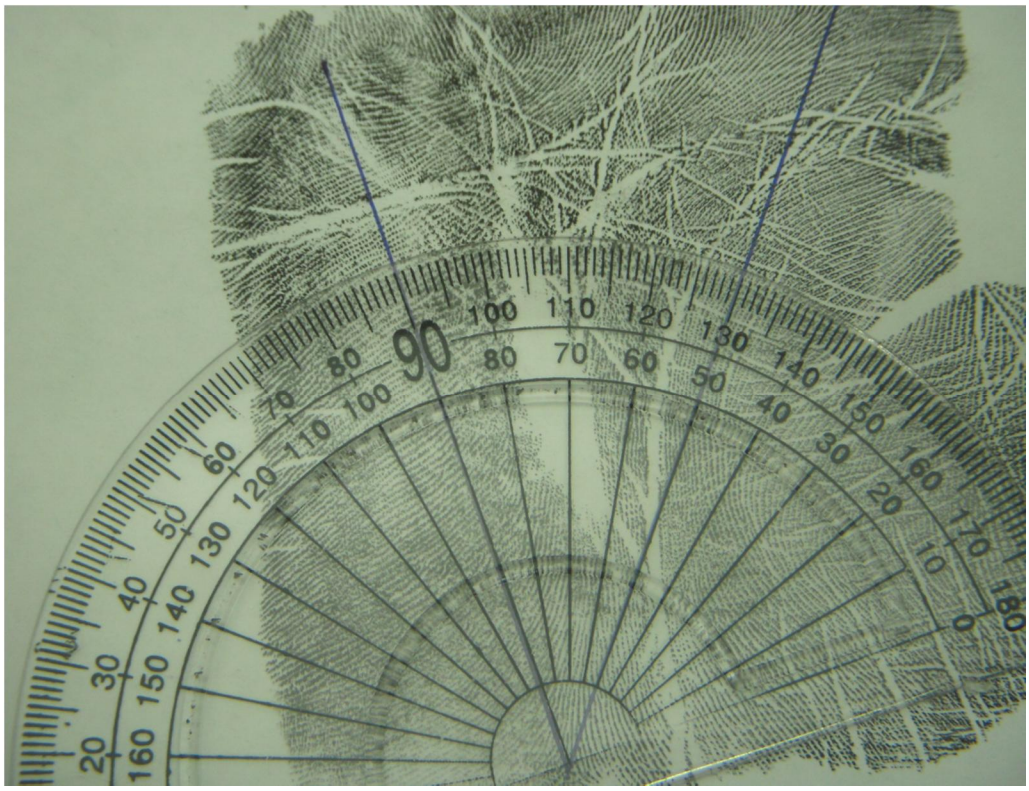
A line is drawn from the digital triradius ‘a’ to the digital triradius‘d’, then from ‘d’ to axial triradii ‘t’. Altered position of ‘t’will affect the adt angle.

dat angle: (Pic.14)

A line is drawn from the digital triradius‘d’ to the digital triradius ‘a’, then from ‘d’ to axial triradii ‘t’. Altered position of ‘t’will affect the dat angle.



Pic. 14: Angle measurement in the palmar dermatoglyphic



Pic. 15: Angle measurement in the palmar dermatoglyphics

METHODS OF STATISTICAL ANALYSIS:

1. Arithmetic mean (X):

This is the most common method for deriving the measure of location.

Arithmetic mean – grouped data:

$$X = \frac{fixi}{fi}$$

F_i = frequency value of the i^{th} class interval

X_i = middle value of theith class interval

Arithmetic mean – ungrouped data:

$$X = \frac{xi}{n}$$

X_i = ithobservation

N = total number of observations.

2. Standard deviation (SD):

SD for grouped data: $\sqrt{fd^2} / N$

Where, d = deviation of items in a series from the mean value

F = frequency of particular class interval

SD for ungrouped data:

$$SD = \sqrt{\sum_{i=1}^{N}(xi - x)^2}$$

X_i = the observed value of sample items

X = mean value of the observations

N = size of the sample.

3. Standard error of mean:

It is a parameter which is used to judge whether the mean of a given sample lies within the set of confidence limits or not

SE = SD/ N

Where N is the size of the sample.

4. Chi – Square test:

In this study, Chi – Square Test is being used to determine the significance between the frequencies of cases and control with regards to pattern found in finger tip.

This type of test is employed when there are 2 types of random variables and they also yield 2 types of data: categorical and numerical. It is used to investigate whether distribution of categorical variables differ from one another.

The formula for determining the significance in this method is:

$$X^2 = \sum \frac{(\text{observed} - \text{expected})^2}{\text{Expected}}$$

Chi – square statistics, the significance X^2 is calculated by the following steps:

- For each of the observed number in the table, subtract the corresponding expected number (O – E)

- Take the square value of the difference $(O - E)^2$
- Then divide the squares obtained for each cell in the table by expected number for that cell $[(O - E)^2 / E]$
- Sum up all the values $[(O - E)^2 / E]$. This is the method of determining significance in Chi – Square method.

5. Student's t – Test (Independent)

It is used when 2 separate sets of independent and identically distributed samples are obtained, one from each of the two population, which are being compared.

Independent 2 sample test:

For this test, the sample size should be equal, and also with equal variants. The test is used only when both the two sample sizes number n is equal. In this test, it can be assumed that the 2 distribution have the same variables. It is used to test whether the means of the 2 groups are different and can be calculated as follows:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{S_{X_1 X_2} \cdot \sqrt{\frac{2}{n}}}$$

Where

$$S_{X_1X_2} = \sqrt{\frac{1}{2}(S_{X_1}^2 + S_{X_2}^2)}$$

Here,S_{X1X2} is the grand standard deviation or the pooled standard deviation. The denominator of t is the standard error of the difference between the means of the 2 groups. For significance testing, the degrees of freedom for this test are 2n-2, where n denotes the number of participants in each group.

6. Levene'sTest:

It is an inferential statistical method used in assessing the parameter of equality in variances in different groups of the study. It is used in testing the issue of null hypothesis that the taken population variances in a study are equal.

After applying this statistical method, if the concluding p – value is less than an accepted critical value (less than < 0.05), it is considered to be significant. The significance implies that it is unlikely that the differences obtained among the group are to be based on random sampling from a population study with equality in variances.

The test statistic is denoted by W. the formula for deriving the W:

$$W = \frac{(N-k)\sum_{i}^{k}=1 N_i (Z_i - Z_{..})^2}{(k-1)\sum_{I}^{k}=1 \sum_{j}^{Ni}=1 (Z_{ij} - Z_i)^2}$$

Where,

W = is the result of the test done

k = denotes the number of different groups of the study from which the samples for the study are derived.

N = refers to the total number of samples in the study

N_i = denotes the total number of samples in the i^{th} group.

Y_{ij}= denotes the value of the j^{th} sample from the i^{th}group

$$Z_{ij} = \begin{cases} |Y_{ij} - \bar{Y}_{i\cdot}|, & \bar{Y}_{i\cdot} \text{ is a mean of i-th group} \\ |Y_{ij} - \tilde{Y}_{i\cdot}|, & \tilde{Y}_{i\cdot} \text{ is a median of i-th group} \end{cases}$$

Where $Y_{ij}$is the value of the j^{th} sample from the i^{th} group

$Z_{..} = \frac{1}{N}\sum_{i=1}^{k}\sum_{j=1}^{N_i} Z_{ij}$ is the mean of all Z_{ij},

$Z_{i.} = \frac{1}{N_i}\sum_{j=1}^{N_i} Z_{ij}$ is the mean of the Z_{ij} for group i.

The significance of W is tested against $F(\alpha, k-1, N-k)$ where F is a quantile of F – K test distribution, with $k-1$ and $N-k$ its degrees of freedom, and α is the chosen level of significance (usually 0.05 or 0.01)

OBSERVATION

The dermatoglyphic pattern collected from 100 histologically confirmed cases of breast cancer patients and 100 age matched controls were studied for differences. The patterns were analyzed both qualitatively and quantitatively.

The parameters taken were:

1. Qualitative parameters assessed:
    a. Arches
    b. Whorls
    c. Loops
2. Quantitative parameters assessed:
    a. Total finger ridge count (TFRC)
    b. Absolute finger ridge count (AFRC)
    c. a – b ridge count
    d. angles of the palm:
        i. atd angle
        ii. dat angle
        iii. adt angle.

In this study, 100 histologically confirmed cases for treatment in Institute of Radiotherapy and Dept. of Surgery, Rajiv Gandhi Govt. General Hospital, Chennai – 03. Hundred age matched women were taken as controls. Subjects with other clinical conditions like diabetes, hypertension, coronary artery disease, asthma, and skin diseases were excluded from the study.

ANALYSIS OF QUALITATIVE PARAMETERS

a. Comparison Of Finger Tip Pattern In Total Number Of Cases And Control – Percentage Wise Distribution: (table 1,chart 1,2)

The percentage of arches in all fingers of the cases is 2.9%, and in that of controls, the percentage is 6%. The percentage of whorls in all the fingers of the cases is 36.1%, the percentage in controls is 32.1%. It was found that the percentage of loops in all the fingers of the cases is 61%, while that in controls is 61.9%. The difference in percentage of arches between cases and controls was 3.1%, the difference in whorls percentage between cases and controls was 4%, and the difference in percentage among the loops of cases and controls is 0.9%. (Table 1,chart 1 ,2)

Comparison Of Finger Tip Pattern- Percentage Wise Distribution

Table 1

TYPE	CASES						CONTROL					
	RT HAND (n=100)		LT HAND (n=100)		BOTH RT+LT (n=100)		RT HAND (n=100)		LT HAND (n=100)		BOTH RT+LT (n=100)	
	No	%	No	%	No	%	No	%	No	%	No	%
A	17	3.4	12	2.4	29	2.9	36	7.2	24	4.8	60	6
W	180	36	181	36.2	361	36.1	152	30.4	169	33.8	321	32.1
L	303	60.6	307	61.4	610	61	312	62. 4	307	61.4	619	61.9
TOTAL	500	100	500	100	1000	100	500	100	500	100	1000	100

A-Arch, W-Whorl, L-Loop, n=number of cases and controls.

The difference in percentage of arches between cases and controls was 3.1%, and the difference in whorls percentage between cases and controls was 4%, and the difference in percentage among the loops of cases and controls is 0.9%.

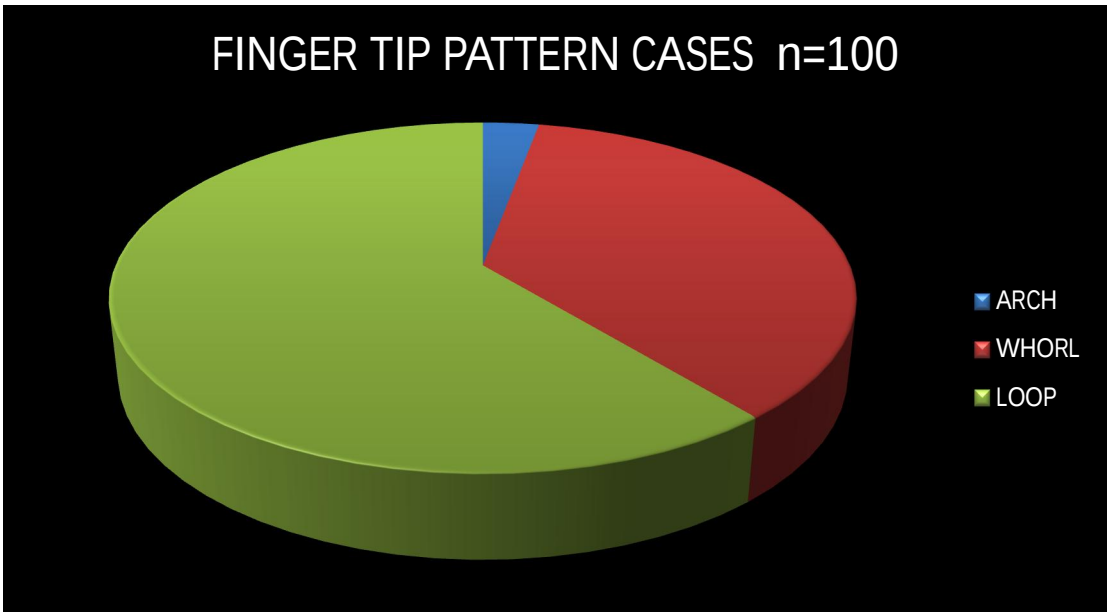


Chart. 1. Percentage of Fingertip patterns in breast cancer Cases

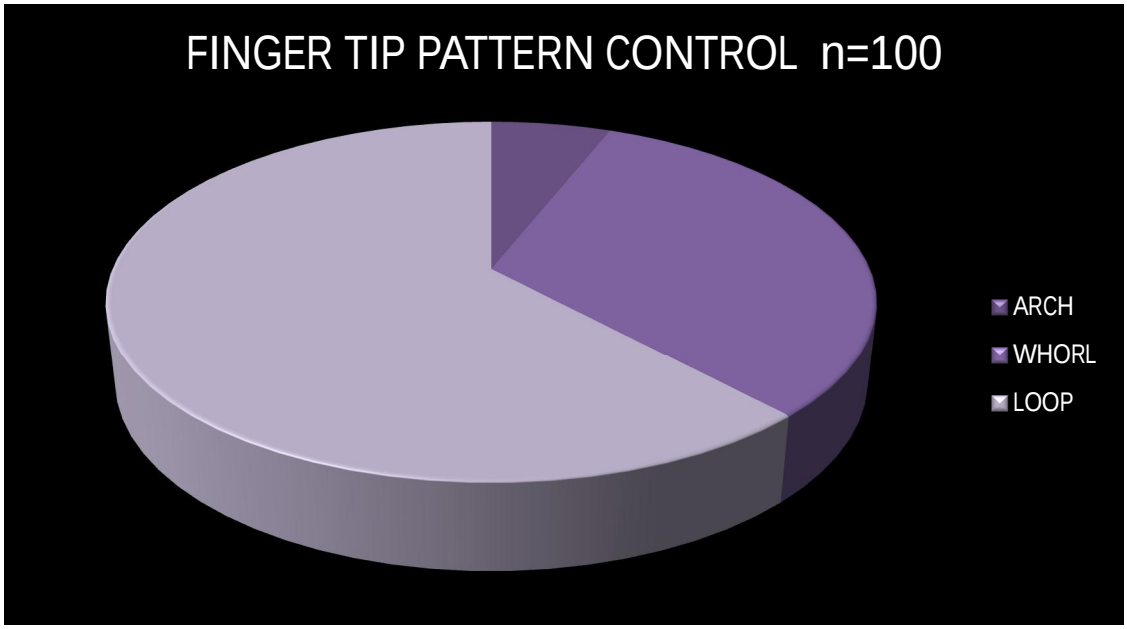


Chart. 2. Percentage of Fingertip patterns in Controls

b. <u>Analysis Of Finger Tip Patterns – In Digits separate , Right Hand</u>

A statistical difference in the loops (0.028) between the cases and controls of index finger was found in this study. Also, the difference in whorls between the cases and controls in the ring finger (p value = 0.048) , was found to be statistically significant.(table 2,chart 3)

<u>Table 2</u>

RIGHT HAND						
DIGIT	FINGER TIP PATTERN	CASE	CONTROL	CHI SQUARE VALUE	p VALUE	REMARK
THUMB	ARCHES	2	5	1.286	0.257	NS
	WHORLS	45	43	0.45	0.831	NS
	LOOPS	53	52	0.010	0.922	NS
INDEX	ARCHES	7	14	0.846	0.106	NS
	WHORLS	23	31	0.674	0.203	NS
	LOOPS	70	55	3.987	0.028*	S
MIDDLE	ARCHES	7	13	1.800	0.180	NS
	WHORLS	42	27	3.261	0.071	NS
	LOOPS	51	60	0.730	0.393	NS
RING	ARCHES	1	3	0.817	0.179	NS
	WHORLS	58	43	3.760	0.048*	S
	LOOPS	41	54	1.385	0.239	NS
LITTLE	ARCHES	0	1	-	>0.05	NS
	WHORLS	12	8	0.800	0.371	NS
	LOOPS	88	91	0.089	0.766	NS

S-Significant,NS-Non Significant, *-Significant at 5% Level

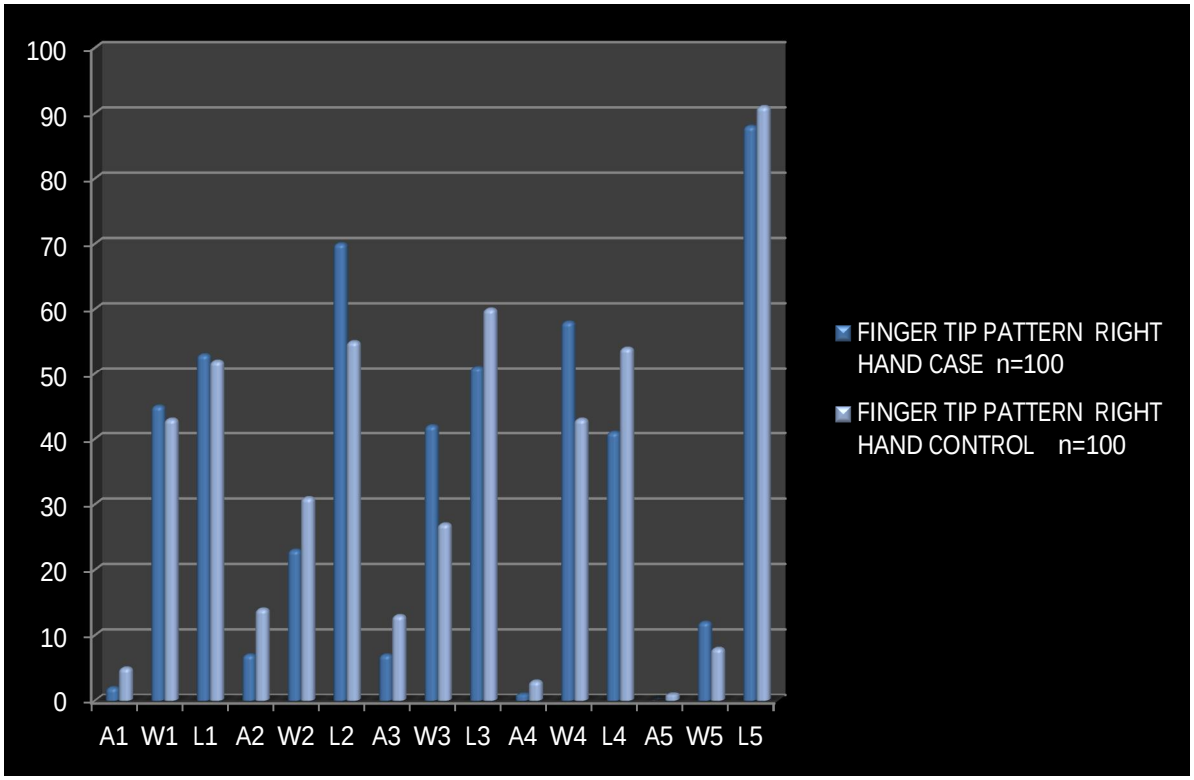


Chart 3 -Bar diagram showing comparison of cases and controls in right hand, digits separate

c. Analysis Of Finger Tip Patterns – In Digits Separate, Left hand

A statistical difference in the whorls (0.048) between the cases and controls of ring finger was found in this study. (Table 3, chart4)

Table 3

LEFT HAND						
DIGIT	FINGER TIP PATTERN	CASE	CONTROL	CHI SQUARE VALUE	p VALUE	REMARK
THUMB	ARCHES	1	2	0.333	0.564	NS
	WHORLS	45	43	0.190	0.663	NS
	LOOPS	54	55	0.221	0.638	NS
INDEX	ARCHES	4	7	0.818	0.366	NS
	WHORLS	43	50	0.527	0.468	NS
	LOOPS	53	43	1.042	0.307	NS
MIDDLE	ARCHES	6	10	1.000	0.317	NS
	WHORLS	30	27	0.532	0.466	NS
	LOOPS	64	63	0.591	0.442	NS
RING	ARCHES	1	4	0.817	0.179	NS
	WHORLS	50	35	3.760	0.048*	S
	LOOPS	49	61	0.571	0.157	NS
LITTLE	ARCHES	0	1	-	>0.005	NS
	WHORLS	13	14	0.037	0.847	NS
	LOOPS	87	85	0.879	0.879	NS

S-Significant, NS-Non Significant, *-Significant at 5% Level

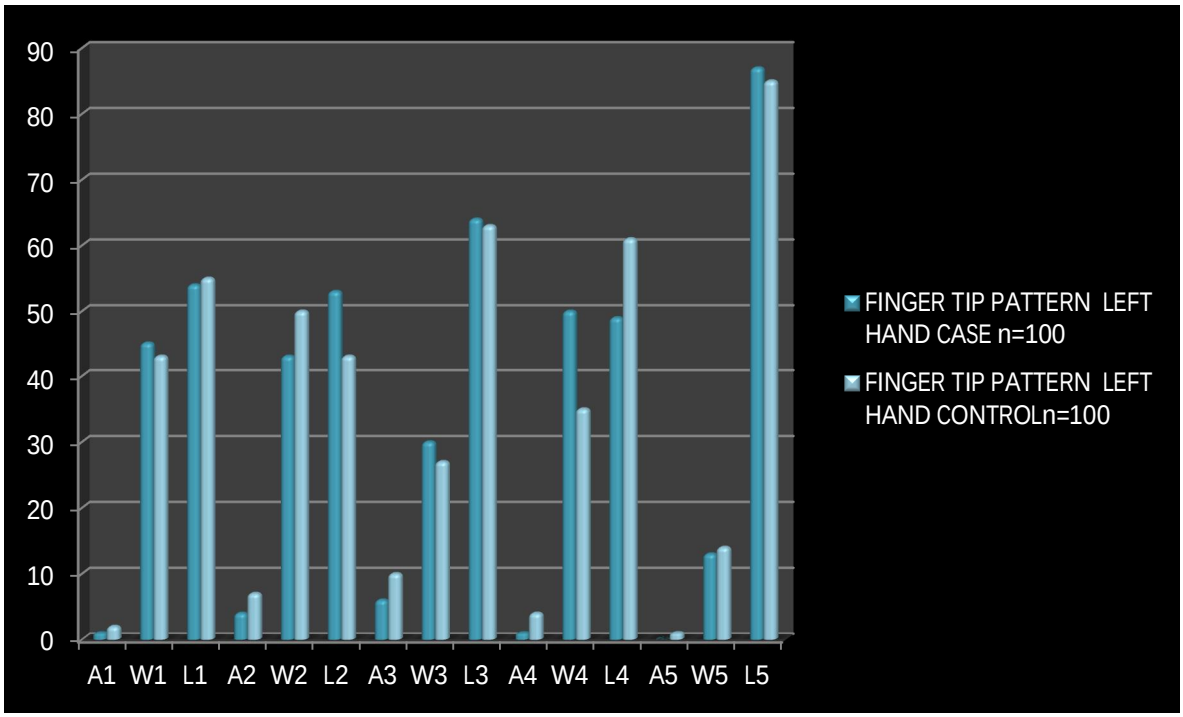


Chart 4 -Bar diagram showing comparison of cases and controls in left hand ,digits separate

d. Analysis Of Finger Tip Patterns – In Digits, Both Hands.

Table 4

BOTH HAND						
DIGIT	PATTERN	CASE	CONTROL	CHI SQUARE VALUE	p VALUE	REMARK
THUMB	ARCHES	3	7	1.600	0.206	NS
	WHORLS	90	86	0.023	0.879	NS
	LOOPS	107	107	0.165	0.684	NS
INDEX	ARCHES	11	21	1.042	0.307	NS
	WHORLS	66	81	1.567	0.987	NS
	LOOPS	123	98	3.451	0.058[a]	NEAR. S
MIDDLE	ARCHES	13	23	2.778	0.196	NS
	WHORLS	72	54	0.862	0.353	NS
	LOOPS	115	123	2.778	0.096	NS
RING	ARCHES	2	7	2.423	0.0832	NS
	WHORLS	108	78	3.998	0.008**	S
	LOOPS	90	115	3.254	0.058[a]	NEAR. S
LITTLE	ARCHES	0	2	-	>0.05	NS
	WHORLS	25	22	0.532	0.468	NS
	LOOPS	175	176	0.102	0.102	NS

S-Significant, NS-Non Significant,**-Significant at 1% Level, a-Near Significant.

A statistical difference in the whorls (p value = 0.008) between the cases and controls of ring finger was found in this study. Also, the difference in loops between the cases and controls in the index and rings finger (p value=0.058) showed near significance statistically.(Table 4,chart 5 **)**

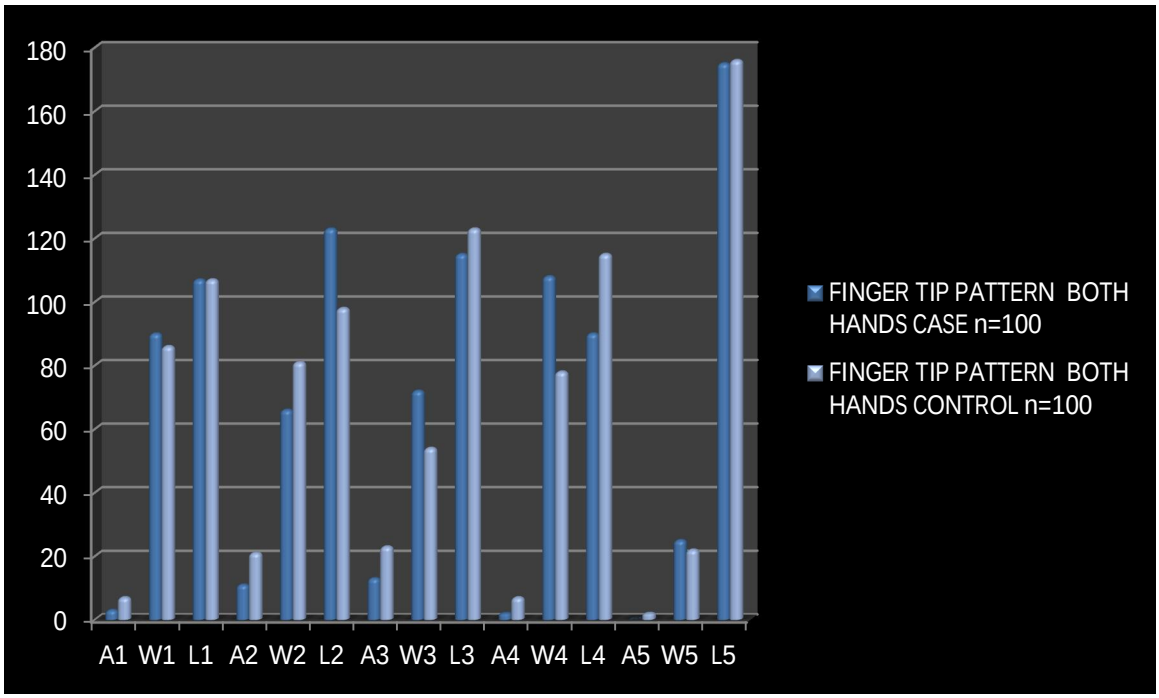


Chart 5 -Bar diagram showing comparison of cases and controls in both hands, digits separate

ANALYSIS OF QUANTITATIVE PARAMETERS

Based on the ridge counts, the parameters taken are:

a. Total Finger Ridge Count (TFRC) – Statistical Evaluation

The difference in the mean value of TFRC values between cases and controls were, RT side- 11.52 and left side - 10.60 and with respect to both hands, the difference in mean value was 22.12. All the values of TFRC, right side and left side and both together were compared statistically using the 2- tailed independent sample t- test, and it was found that the values against cases and controls had a significant difference, $p < 0.001$.(table 5, chart6)

Table 5

TFRC	MEAN±SD		p VALUE	REMARK
	CASES (n=100)	CONTROL (n=100)		
RIGHT	63.13±13.546	51.61±12.947	<0.001**	S
LEFT	62.88±13.586	52.28±12.898	<0.001**	S
TOTAL	126.01±18.763	103.89±17.754	<0.001**	S

**- Significant at 1%, S –Significant.

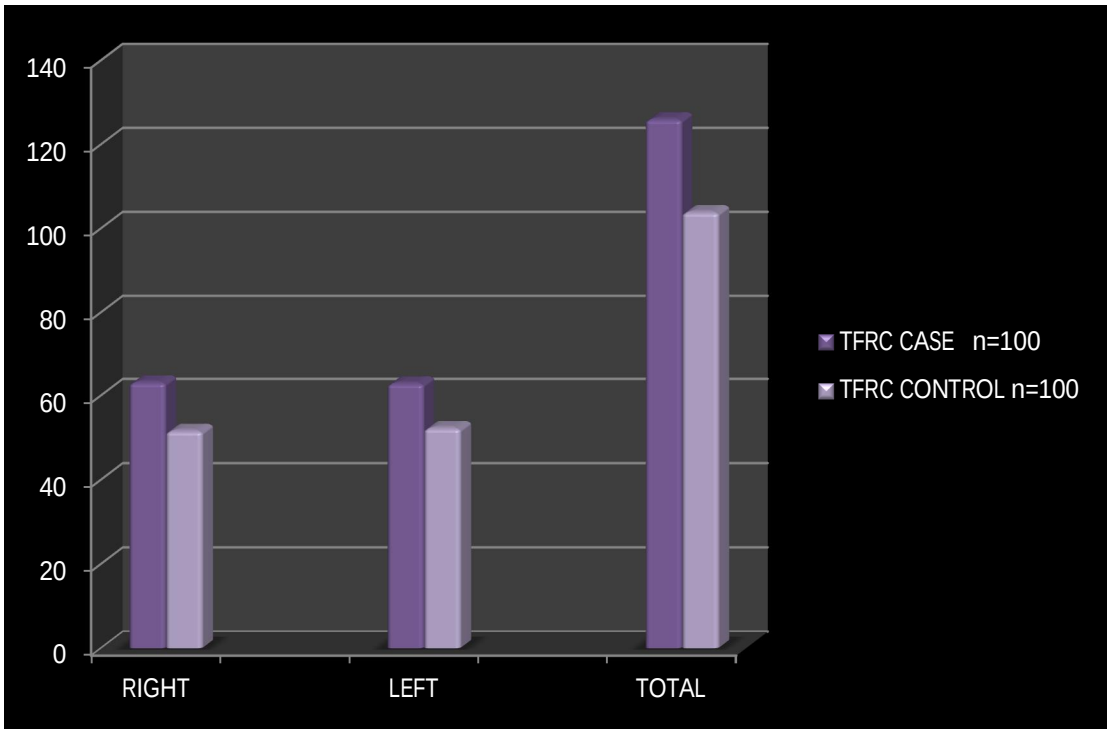


Chart 6 - Bar diagram showing comparison of total finger ridge count in cases and controls

b. Absolute Finger Ridge Count (AFRC) - Statistical Evaluation

Table 6

AFRC	MEAN±SD		p value	REMARK
	CASES (n=100)	CONTROL (n=100)		
RIGHT HAND	77.04±9.672	65.02±8.987	<0.001**	S
LEFT HAND	76.72±9.951	64.72±8.876	<0.001**	S
BOTH HANDS	153.76±14.714	129.74±14.021	<0.001**	S

**- Significant at 1%, S –Significant.

The difference in the mean value of AFRC values between cases and controls were, RT side- 12.02 and left side- 12 and with respect to both hands, the difference in mean value was 24.02. All the values of AFRC, right side and left side and both together were compared statistically using the 2- tailed independent sample t- test, and it was found that the values against cases and controls had a significant difference, $p < 0.001$.(Table 6,chart 7)

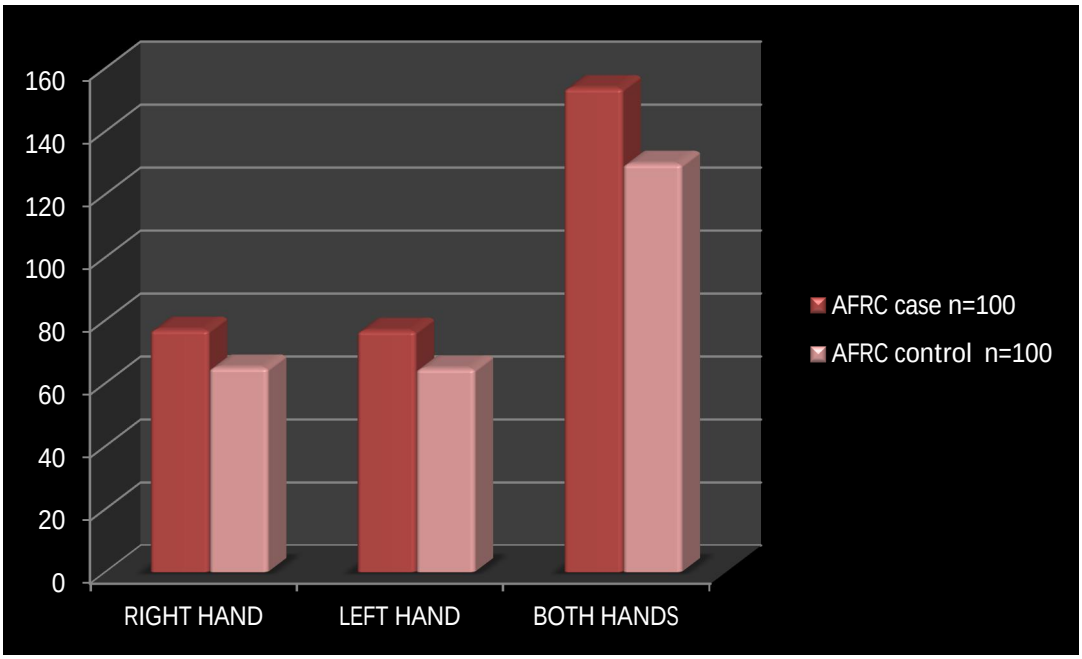


Chart 7 - Bar diagram showing comparison of absolute finger ridge count in cases and controls

c. a – b Ridge count – statistical evaluation

The a-b ridge count in all the cases and control were assessed separately on both sides .The difference in the mean value of ABRC values between cases and controls were, Right side - 5.48 and left side - 7.99 and with respect to both hands, the difference in mean value was 13.48. All the values of ABRC, right side and left side and both together were compared statistically using the 2- tailed independent sample t- test, and it was found that the values against cases and controls had a significant difference, $p < 0.001$.(table 7,chart 8)

Table 7

ABRC	MEAN±SD		p VALUE	REMARK
	CASES (n=100)	CONTROL (n=100)		
RIGHT	32.26±6.045	26.77±6.242	<0.001**	S
LEFT	33.10±4.939	25.11±6.361	<0.001**	S
TOTAL	65.36±8.613	51.88±12.581	<0.001**	S

**- Significant at 1%, S –Significant.

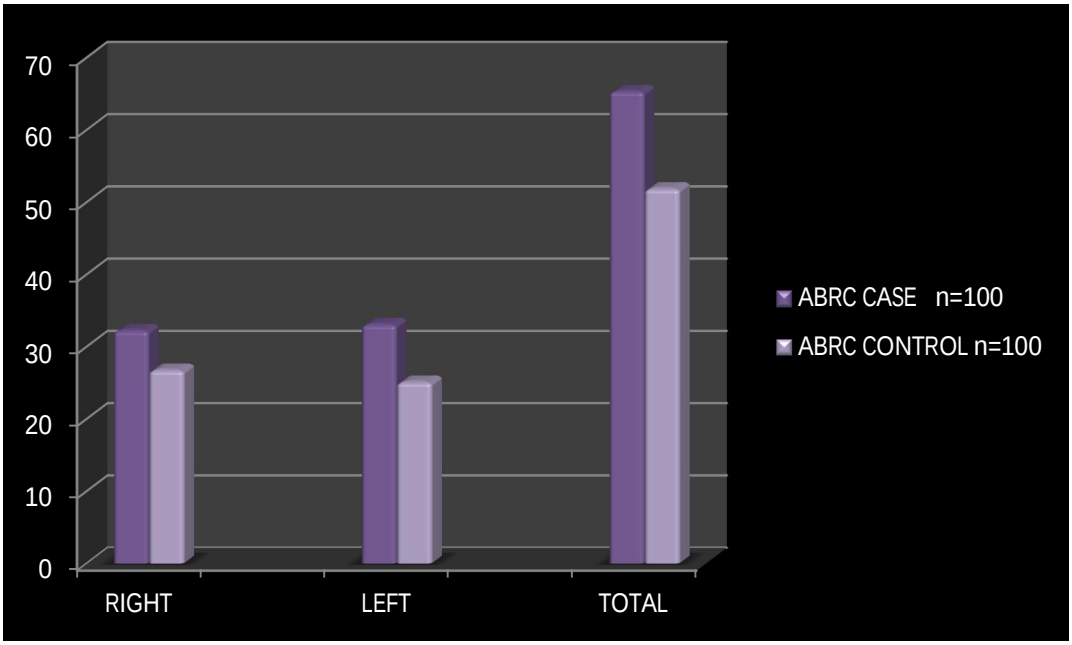


Chart 8 - Bar diagram showing comparison of a-b ridge count in cases and controls

d. Angles of the Palm

atd,dat,adt angles Right and left hands were assessed separately

Right hand

The atd, dat and adt angles were compared for the right hand between cases and controls. The data was statistically evaluated using the t test, and was found that the adt angles between cases and controls showed a statitiscal significance (p value = 0.026) .(table 8,chart 9).

Table 8

RIGHT HAND			
ANGLE	MEAN±SD		p VALUE
	Cases	Control	
Atd	42.77±4.707	42.69±4.809	0.905
Dat	58.95±5.059	57.24±5.159	0.195
Adt	78.28±5.591	80.07±5.732	0.026*

***** - Significant at 5% level

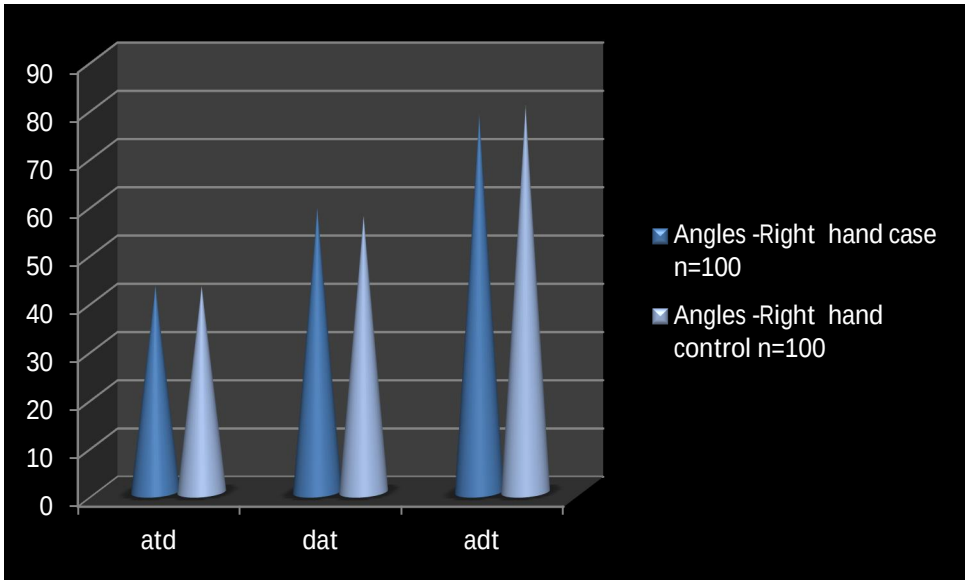


Chart 9 - Bar diagram showing comparison of atd, dat, adt angles- in cases and controls (Right hand)

Left hand

Table 9

LEFT HAND			
ANGLE	CASES	CONTROL	p VALUE
atd	43.99±4.701	42.97±4.711	0.653
dat	57.82±5.142	56.84±5.098	0.137
adt	78.19±5.47	80.19±5.460	0.010**

****** - Significant at 1% level

The atd, dat and adt angles were compared for the left hand between cases and controls. The data was statistically evaluated using the t test, and was found that the adt angles between cases and controls showed a statistical significance. (p value = 0.010) (Table 9,chart 10)

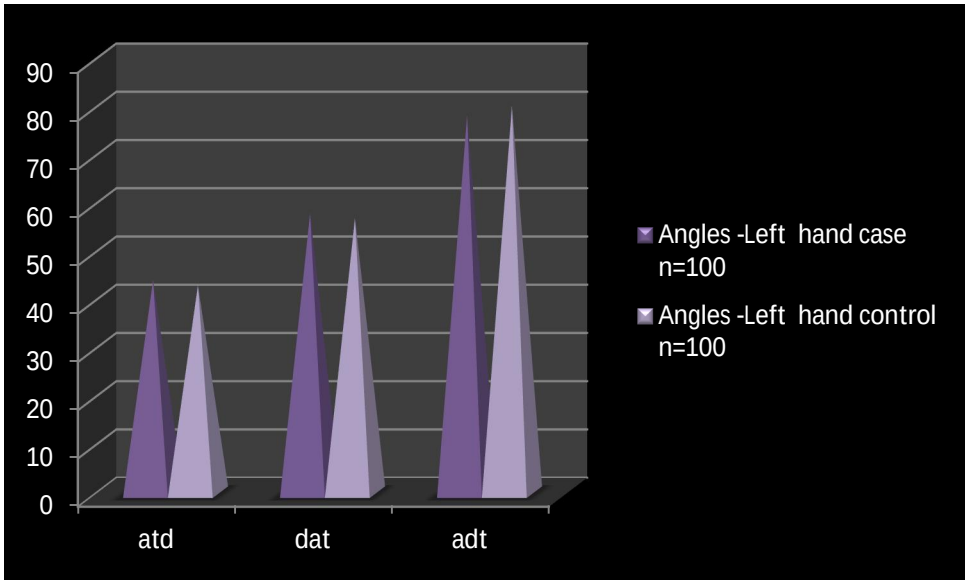


Chart 10- Bar diagram showing comparison of atd, dat, adt angles- in cases and controls (Left hand)

MASTER SHEET - CASES

CASES																							
	RIGHT HAND										LEFT HAND										BOTH HANDS		
	QUALITATIVE					QUANTITATIVE					QUALITATIVE					QUANTITATIVE					QUANTITATIVE		
	FINGER TIP PATTERN					RIDGE COUNT		ANGLES OF THE PALM			FINGER TIP PATTERN					RIDGE COUNT		ANGLES OF THE PALM			TOTAL - RIDGE COUNT		
CASE NO	THUMB	INDEX	MIDDLE	RING	LITTLE	TFRC	ABRC	atd	dat	adt	THUMB	INDEX	MIDDLE	RING	LITTLE	TFRC	ABRC	atd	dat	adt	TFRC	AFRC	ABRC
1	L	L	A	L	L	65	35	52	55	73	L	L	L	W	L	66	33	39	66	75	131	150	68
2	W	L	W	W	L	66	36	46	59	75	W	W	L	L	W	64	41	50	59	71	130	140	77
3	W	L	W	L	L	53	37	50	57	73	W	L	W	W	L	62	29	39	62	79	115	133	66
4	L	L	W	W	L	53	28	41	66	73	L	L	A	W	L	72	34	40	57	83	125	157	62
5	L	L	L	L	L	59	26	43	63	74	L	W	L	W	L	64	31	53	48	79	123	158	57
6	L	W	W	L	W	62	42	56	60	64	L	W	W	L	L	70	38	54	51	75	132	154	80
7	W	L	L	W	L	67	39	49	55	76	W	L	L	L	L	71	33	40	66	74	138	178	72
8	W	W	L	L	L	20	33	51	59	70	W	W	L	W	L	61	29	39	61	80	81	134	62
9	L	L	W	W	L	71	27	38	67	75	L	L	L	W	L	73	34	52	51	77	144	188	61
10	W	L	W	L	L	86	25	44	66	70	W	L	L	W	L	63	30	39	64	77	149	164	55
11	L	L	L	W	L	34	28	45	63	72	L	L	L	W	L	58	29	47	56	77	92	136	57
12	W	A	W	W	W	71	33	40	64	76	W	W	L	L	L	57	31	49	50	81	128	143	64
13	W	L	L	L	L	64	36	39	62	79	W	L	A	L	L	42	31	51	48	81	106	151	67
14	W	L	L	W	L	73	31	36	60	84	W	L	L	W	L	59	23	50	50	80	132	159	54
15	L	A	L	W	L	31	38	41	57	82	L	W	W	L	L	57	23	45	58	77	88	133	61
16	L	L	L	W	W	47	27	40	58	82	L	L	L	W	L	66	34	52	58	70	113	147	61
17	W	W	L	L	L	66	20	42	56	82	W	W	L	W	W	77	32	44	62	74	143	168	52
18	W	L	L	W	L	49	27	44	58	78	L	L	L	W	L	62	28	49	61	70	111	190	55
19	W	L	W	L	L	73	28	48	61	71	W	L	L	L	L	68	41	47	57	76	141	165	69
20	W	L	L	W	L	79	23	39	59	82	W	W	L	W	W	80	23	50	53	77	159	181	46
21	L	L	W	W	L	74	23	42	66	72	L	L	W	L	L	34	39	41	62	77	108	131	62
22	L	A	L	W	L	83	29	36	60	84	L	A	A	L	L	70	34	33	70	77	153	171	63
23	L	A	L	L	L	67	35	49	64	67	W	W	L	W	L	76	32	43	54	83	143	161	67
24	L	L	L	W	L	71	33	47	65	68	W	W	L	W	L	67	29	43	62	75	138	161	62
25	W	L	L	L	W	49	28	35	66	79	L	W	L	L	L	77	32	39	61	80	126	158	60
26	W	L	A	W	L	65	23	41	60	79	L	L	L	W	L	56	23	38	65	77	121	150	46
27	W	W	W	L	L	66	25	40	58	82	L	W	W	L	W	79	31	42	61	77	145	174	56
28	L	L	L	W	L	67	28	43	62	75	W	L	L	L	L	80	31	46	53	81	147	169	59
29	W	L	W	L	W	68	29	43	57	80	W	L	L	W	W	67	33	49	57	74	135	151	62
30	L	W	W	W	L	66	33	36	60	84	L	W	L	L	L	53	39	46	51	83	119	147	72
31	L	A	L	W	L	65	33	48	60	72	W	W	W	L	L	55	30	51	52	77	120	152	63
32	W	L	L	W	L	84	29	40	59	81	L	L	L	W	L	65	28	44	54	82	149	178	57
33	W	W	L	L	L	46	33	39	65	76	W	W	W	W	L	76	31	51	54	75	122	146	64

CASES																								
	RIGHT HAND										LEFT HAND										BOTH HANDS		
	QUALITATIVE					QUANTITATIVE					QUALITATIVE					QUANTITATIVE					QUANTITATIVE		
	FINGER TIP PATTERN					RIDGE COUNT		ANGLES OF THE PALM			FINGER TIP PATTERN					RIDGE COUNT		ANGLES OF THE PALM			TOTAL - RIDGE COUNT		
CASE NO	THUMB	INDEX	MIDDLE	RING	LITTLE	TFRC	ABRC	atd	dat	adt	THUMB	INDEX	MIDDLE	RING	LITTLE	TFRC	ABRC	atd	dat	adt	TFRC	AFRC	ABRC
34	L	L	W	L	L	49	31	49	60	71	W	L	L	L	L	65	33	50	55	75	114	160	64
35	W	L	W	W	L	55	25	39	61	80	W	L	L	W	L	84	31	43	55	82	139	158	56
36	L	L	L	W	L	58	31	40	66	74	L	L	L	W	L	65	32	51	53	76	123	147	63
37	L	L	W	W	L	71	24	40	65	75	L	L	W	W	L	65	26	40	58	82	136	153	50
38	L	L	L	W	L	31	37	41	62	77	W	L	L	L	L	64	41	51	54	75	95	133	78
39	L	L	W	L	L	43	21	44	56	80	A	L	W	L	L	73	29	36	69	75	116	142	50
40	L	A	W	L	L	66	32	45	54	81	W	W	L	W	L	59	41	39	58	83	125	142	73
41	L	L	W	W	L	72	35	45	54	81	W	L	L	L	L	51	39	46	51	83	123	139	74
42	W	W	L	L	L	83	29	43	59	78	L	W	L	W	L	69	36	42	59	79	152	163	65
43	L	L	L	W	L	57	32	41	60	79	L	L	L	W	L	77	38	48	50	82	134	151	70
44	W	L	W	W	W	75	33	39	60	81	L	L	W	L	L	68	33	40	57	83	143	158	66
45	L	L	L	W	L	67	31	45	56	79	L	L	L	W	L	71	39	44	54	82	138	165	70
46	L	L	W	L	L	68	29	39	56	85	W	L	W	W	L	49	34	45	61	74	117	145	63
47	L	L	W	W	W	64	41	40	57	83	W	L	L	L	L	58	39	44	60	76	122	147	80
48	L	W	L	L	L	94	29	39	60	81	W	W	L	W	L	56	33	41	52	87	150	167	62
49	A	A	L	L	L	34	36	40	57	83	W	W	L	L	L	57	32	47	56	77	91	132	68
50	W	L	W	W	L	35	36	42	59	79	W	L	L	L	L	71	33	45	59	76	106	146	69
51	W	L	W	W	L	66	31	42	54	84	L	L	L	L	L	64	35	46	58	76	130	147	66
52	W	L	L	L	L	63	34	40	59	81	W	L	W	L	W	65	43	49	57	74	128	144	77
53	L	L	L	W	L	62	36	43	54	83	L	W	L	W	L	52	31	46	54	80	114	163	67
54	W	W	L	L	W	72	31	42	51	87	L	W	W	L	L	52	37	42	63	75	124	139	68
55	L	L	W	L	L	64	31	45	55	80	W	L	L	W	L	58	33	43	61	76	122	147	64
56	L	L	W	W	W	60	33	39	57	84	W	W	W	L	L	61	40	40	67	73	121	166	73
57	W	L	L	L	L	71	33	39	57	84	L	L	L	L	L	66	35	41	56	83	137	166	68
58	W	W	W	L	L	61	29	44	53	83	W	W	W	W	W	19	31	44	57	79	80	134	60
59	L	L	L	W	L	73	35	40	63	77	L	W	L	A	L	70	36	41	57	82	143	156	71
60	W	W	W	L	L	68	33	47	54	79	L	W	L	W	L	85	32	38	66	76	153	165	65
61	L	L	A	L	L	58	29	37	60	83	L	L	A	W	L	33	31	42	63	75	91	123	60
62	L	L	W	W	L	37	31	40	57	83	L	L	L	W	W	70	33	40	58	82	107	143	64
63	L	L	L	W	L	42	37	41	58	81	L	W	W	L	L	63	33	43	56	81	105	145	70
64	L	W	L	W	L	59	25	44	59	77	L	W	L	L	L	72	25	44	54	82	131	167	50
65	L	L	W	L	L	57	29	41	60	79	W	W	L	L	L	30	25	36	72	72	87	122	54
66	L	W	A	L	L	66	29	40	60	80	L	W	L	W	L	46	36	41	62	77	112	156	65
67	W	L	W	W	L	77	25	39	64	77	W	L	L	L	L	65	34	52	50	78	142	150	59

CASES																								
	RIGHT HAND										LEFT HAND										BOTH HANDS		
	QUALITATIVE					QUANTITATIVE					QUALITATIVE					QUANTITATIVE					QUANTITATIVE		
	FINGER TIP PATTERN					RIDGE COUNT		ANGLES OF THE PALM			FINGER TIP PATTERN					RIDGE COUNT		ANGLES OF THE PALM			TOTAL - RIDGE COUNT		
CASE NO	THUMB	INDEX	MIDDLE	RING	LITTLE	TFRC	ABRC	atd	dat	adt	THUMB	INDEX	MIDDLE	RING	LITTLE	TFRC	ABRC	atd	dat	adt	TFRC	AFRC	ABRC
68	L	L	W	L	L	62	59	46	55	79	L	L	A	W	L	48	30	47	54	79	110	145	89
69	W	L	L	A	L	68	41	48	56	76	L	L	A	L	L	72	43	48	54	78	140	167	84
70	L	L	L	W	L	88	33	48	56	76	L	L	W	W	L	78	25	37	65	78	166	189	58
71	L	W	L	L	L	34	29	44	57	79	L	W	L	L	W	73	41	36	68	76	107	134	70
72	L	L	L	W	L	70	35	43	57	80	L	W	L	W	L	82	36	49	55	76	152	176	71
73	L	W	W	W	L	76	33	43	59	78	W	W	W	L	L	66	34	46	59	75	142	156	67
74	A	L	W	L	L	67	29	44	58	78	L	W	L	L	L	70	31	51	55	74	137	165	60
75	W	W	W	W	L	77	33	43	58	79	L	W	W	W	L	48	34	41	64	75	125	156	67
76	L	L	L	L	L	56	35	45	57	78	W	L	L	W	L	65	37	35	69	76	121	156	72
77	W	W	W	W	L	79	31	43	60	77	L	L	W	L	L	66	34	44	56	80	145	181	65
78	W	L	L	W	W	80	35	46	53	81	W	W	W	W	L	67	41	43	56	81	147	165	76
79	W	W	L	L	L	67	37	43	57	80	L	L	L	W	L	68	29	39	58	83	135	156	66
80	L	L	W	W	L	53	31	36	59	85	L	W	L	L	L	66	26	42	53	85	119	148	57
81	L	L	W	L	W	55	35	37	60	83	L	W	W	L	L	65	41	42	58	80	120	152	76
82	W	W	L	W	L	65	43	40	59	81	W	L	L	L	L	84	50	40	58	82	149	164	93
83	W	L	A	W	L	76	61	47	55	78	L	L	W	L	L	46	31	41	58	81	122	145	92
84	L	L	L	W	L	65	27	49	60	71	L	L	W	W	L	49	29	36	62	82	114	150	56
85	W	W	A	L	L	84	31	41	59	80	W	L	L	L	L	55	31	39	61	80	139	156	62
86	L	L	A	W	L	65	31	45	55	80	L	A	W	W	W	58	34	48	50	82	123	145	65
87	W	L	L	W	L	65	27	44	57	79	W	W	L	L	L	71	33	44	56	80	136	171	60
88	W	L	W	L	L	64	39	43	59	78	W	L	W	W	L	37	29	39	61	80	101	131	68
89	W	L	L	W	L	73	33	44	57	79	L	W	L	L	L	43	36	40	64	76	116	170	69
90	L	L	W	W	L	59	31	42	58	80	W	W	W	W	L	66	34	45	54	81	125	146	65
91	L	A	L	L	L	51	35	43	58	79	L	L	L	L	L	72	31	44	56	80	123	147	66
92	W	W	W	W	L	69	37	41	60	79	L	L	W	L	W	63	36	38	63	79	132	168	73
93	L	L	L	W	L	77	31	44	62	74	W	L	L	W	L	67	27	51	49	80	144	156	58
94	W	L	L	W	L	68	35	47	56	77	W	A	L	L	L	50	35	49	52	79	118	154	70
95	W	W	L	L	L	71	35	44	60	76	L	W	W	W	W	67	25	55	47	78	138	154	60
96	L	L	W	L	L	49	33	43	58	79	W	L	L	W	L	68	34	43	59	78	117	147	67
97	L	L	L	L	L	58	33	42	59	79	L	W	L	W	L	64	36	41	61	78	122	148	69
98	W	L	L	W	L	56	36	44	60	76	L	L	W	L	L	50	29	35	67	78	106	147	65
99	L	L	L	L	W	57	36	42	59	79	L	W	L	W	L	64	35	49	51	80	121	135	71
100	W	W	A	W	L	71	33	46	58	76	W	A	W	L	W	60	35	47	63	70	131	137	68

MASTER SHEET - CONTROL

CONTROL																							
	RIGHT HAND										LEFT HAND										BOTH HANDS		
	QUALITATIVE					QUANTITATIVE					QUALITATIVE					QUANTITATIVE					QUANTITATIVE		
	FINGER TIP PATTERN					RIDGE COUNT		ANGLES OF THE PALM			FINGER TIP PATTERN					RIDGE COUNT		ANGLES OF THE PALM			TOTAL -RIDGE COUNT		
CON.NO	THUMB	INDEX	MIDDLE	RING	LITTLE	TFRC	ABRC	atd	dat	adt	THUMB	INDEX	MIDDLE	RING	LITTLE	TFRC	ARRC	atd	dat	adt	TFRC	AFRC	ABRC
1	L	L	W	W	L	53	23	38	56	86	L	W	W	W	L	56	21	40	64	76	109	150	44
2	L	L	L	L	L	54	22	35	65	80	L	W	L	L	L	53	20	44	56	80	107	146	42
3	W	L	L	L	L	41	15	45	60	75	L	W	L	W	L	52	13	44	56	80	93	127	28
4	W	W	A	L	L	41	22	39	52	89	L	L	W	L	W	62	20	34	62	84	103	149	42
5	L	L	L	L	L	47	23	41	53	86	L	W	A	L	L	54	21	42	58	80	101	142	44
6	W	W	W	L	L	50	18	48	58	74	L	L	L	L	L	50	16	43	61	76	100	132	34
7	L	L	L	L	L	55	18	47	57	76	W	W	W	W	L	61	16	41	59	80	116	130	34
8	L	A	L	W	L	24	14	38	67	75	L	L	L	L	L	51	12	42	57	81	75	130	26
9	L	L	L	L	L	59	30	43	57	80	W	W	L	W	L	63	28	37	65	78	122	134	58
10	L	W	L	W	L	61	28	35	64	81	L	L	L	A	L	58	26	40	62	78	119	146	54
11	L	L	A	L	L	22	30	53	45	82	L	W	L	L	L	48	28	45	57	78	70	152	58
12	L	W	A	L	W	59	31	43	46	91	L	W	L	L	W	26	29	39	59	82	85	123	60
13	W	L	W	L	L	52	29	50	47	83	L	W	L	L	L	31	27	52	50	78	83	124	56
14	L	A	L	L	L	61	20	40	57	83	A	L	A	W	L	48	18	50	49	81	109	150	38
15	W	L	L	L	L	20	18	45	54	81	W	L	L	L	L	46	16	58	50	72	66	140	34
16	L	L	W	W	L	36	34	44	59	77	W	W	A	L	L	55	32	46	53	81	91	130	66
17	L	W	L	L	L	55	31	38	55	87	W	W	L	W	L	66	29	45	59	76	121	131	60
18	L	L	W	L	A	38	25	51	48	81	L	W	L	L	L	50	23	42	55	83	88	102	48
19	L	W	L	W	L	62	19	49	54	77	W	W	L	W	L	56	17	50	53	77	118	149	36
20	L	L	W	L	L	68	17	57	47	76	L	L	L	W	L	76	15	48	54	78	144	160	32
21	W	L	W	W	L	63	20	43	56	81	L	L	L	W	L	22	18	54	48	78	85	130	38
22	W	A	L	L	W	72	25	48	57	75	W	W	W	L	L	58	23	41	61	78	130	134	48
23	L	L	L	L	L	56	29	35	65	80	W	L	A	L	L	64	27	40	56	84	120	130	56
24	L	L	W	L	L	60	23	49	55	76	L	W	L	W	L	55	21	51	48	81	115	150	44
25	L	W	L	W	L	38	30	47	52	81	W	W	A	L	W	65	28	40	59	81	103	149	58
26	W	L	W	L	L	54	30	43	57	80	L	W	L	W	L	44	28	42	60	78	98	146	58
27	W	W	W	L	L	55	24	40	61	79	L	L	L	W	L	67	22	41	61	78	122	150	46
28	L	L	L	W	L	56	27	42	55	83	L	W	W	L	L	68	25	42	56	82	124	130	52
29	W	W	W	L	L	57	28	38	60	82	L	L	A	L	W	55	26	37	63	80	112	129	54
30	L	L	L	W	L	55	26	41	52	87	L	L	L	W	L	41	24	40	56	84	96	150	50
31	W	W	W	W	L	54	24	44	49	87	L	W	L	W	L	43	22	39	61	80	97	147	46
32	W	A	L	L	L	73	36	41	56	83	W	W	W	L	L	52	34	43	54	83	125	129	70
33	W	L	A	W	L	35	24	40	53	87	L	L	L	L	L	64	22	47	54	79	99	150	46

CONTROL																								
	RIGHT HAND										LEFT HAND										BOTH HANDS		
	QUALITATIVE					QUANTITATIVE					QUALITATIVE					QUANTITATIVE					QUANTITATIVE		
	FINGER TIP PATTERN					RIDGE COUNT		ANGLES OF THE PALM			FINGER TIP PATTERN					RIDGE COUNT		ANGLES OF THE PALM			TOTAL -RIDGE COUNT		
CON.NO	THUMB	INDEX	MIDDLE	RING	LITTLE	TFRC	ABRC	atd	dat	adt	THUMB	INDEX	MIDDLE	RING	LITTLE	TFRC	ARRC	atd	dat	adt	TFRC	AFRC	ABRC
34	L	A	L	L	L	38	31	43	59	78	W	W	W	L	L	53	29	40	64	76	91	118	60
35	L	L	W	L	L	44	31	42	56	82	L	L	L	W	L	72	29	37	60	83	116	129	60
36	W	W	L	W	L	47	18	36	63	81	L	L	L	W	L	53	16	37	64	79	100	143	34
37	W	L	L	W	L	60	20	39	61	80	L	W	L	L	L	53	18	50	50	80	113	128	38
38	W	L	A	L	L	20	23	46	53	81	L	L	W	W	L	52	21	47	57	76	72	143	44
39	W	A	L	W	L	32	24	44	57	79	A	L	L	L	W	60	22	52	52	76	92	110	46
40	L	L	L	L	L	55	28	36	59	85	W	A	W	W	L	47	26	41	55	84	102	120	54
41	L	A	W	L	L	61	28	41	61	78	L	L	L	W	W	39	26	42	54	84	100	120	54
42	L	A	L	L	L	72	24	52	55	73	W	L	L	L	L	57	22	40	60	80	129	140	46
43	L	W	W	W	L	46	28	47	60	73	W	W	A	L	L	65	26	43	54	83	111	120	54
44	W	L	L	L	L	64	26	41	58	81	W	W	L	L	L	56	24	44	52	84	120	130	50
45	W	L	L	W	L	56	20	51	55	74	L	W	W	W	L	59	18	36	58	86	115	130	38
46	W	W	W	W	W	57	26	46	55	79	L	L	L	A	L	37	24	46	55	79	94	120	50
47	L	L	A	L	L	53	19	49	49	82	W	L	W	W	W	46	17	39	61	80	99	116	36
48	W	L	L	L	L	83	32	36	67	77	W	W	L	A	L	44	30	36	56	88	127	140	62
49	L	W	W	L	L	23	16	37	64	79	L	L	L	L	L	45	14	42	60	78	68	98	30
50	L	A	L	W	L	24	26	48	57	75	W	A	A	L	L	59	24	43	58	79	83	100	50
51	W	L	L	W	L	55	54	41	62	77	L	W	L	L	L	54	52	43	60	77	109	126	106
52	W	W	L	L	W	52	36	44	56	80	W	L	L	L	L	55	34	46	54	80	107	123	70
53	L	L	L	W	L	51	28	41	61	78	W	A	W	W	L	42	26	48	51	81	93	106	54
54	W	L	L	L	L	61	24	36	59	85	W	W	L	W	W	42	22	34	60	86	103	110	46
55	L	L	L	W	L	53	30	39	52	89	L	L	W	L	L	48	28	40	63	77	101	120	58
56	L	L	A	W	L	49	28	46	52	82	L	W	L	A	L	51	26	42	59	79	100	118	54
57	L	L	L	W	L	60	24	42	51	87	W	L	W	W	L	56	22	44	62	74	116	130	46
58	W	L	A	L	L	50	28	48	45	87	L	W	L	L	L	25	26	39	61	80	75	97	54
59	L	A	L	L	L	62	26	42	63	75	W	W	W	W	L	60	24	39	58	83	122	130	50
60	L	L	L	W	W	57	29	39	58	83	W	L	L	L	L	62	27	44	55	81	119	130	56
61	W	W	L	L	L	47	31	43	57	80	L	W	L	L	L	23	29	48	52	80	70	90	60
62	L	L	L	W	L	25	26	44	47	89	L	L	L	W	L	60	24	41	56	83	85	115	50
63	W	L	L	W	L	30	26	35	60	85	W	W	L	L	L	53	24	35	63	82	83	105	50
64	L	L	W	L	L	47	28	44	54	82	L	A	W	L	W	62	26	48	49	83	109	110	54
65	L	L	A	L	L	45	28	40	59	81	W	W	L	W	L	21	26	46	51	83	66	90	54
66	W	L	L	W	L	54	24	38	57	85	L	L	L	L	L	37	22	49	53	78	91	110	46
67	L	W	A	W	L	65	30	42	53	85	W	W	L	L	L	56	28	54	50	76	121	130	58

CONTROL																								
	RIGHT HAND										LEFT HAND										BOTH HANDS		
	QUALITATIVE					QUANTITATIVE					QUALITATIVE					QUANTITATIVE					QUANTITATIVE		
	FINGER TIP PATTERN					RIDGE COUNT		ANGLES OF THE PALM			FINGER TIP PATTERN					RIDGE COUNT		ANGLES OF THE PALM			TOTAL -RIDGE COUNT		
CON.NO	THUMB	INDEX	MIDDLE	RING	LITTLE	TFRC	ABRC	atd	dat	adt	THUMB	INDEX	MIDDLE	RING	LITTLE	TFRC	ARRC	atd	dat	adt	TFRC	AFRC	ABRC
68	A	A	L	L	L	50	28	46	49	85	W	W	L	L	L	39	26	40	60	80	89	100	54
69	W	L	L	L	L	56	24	39	60	81	L	L	A	L	L	63	22	39	62	79	119	127	46
70	W	L	W	L	L	76	26	36	63	81	L	W	L	L	A	69	24	52	49	79	145	150	50
71	W	L	A	W	L	22	32	41	65	74	L	W	W	L	L	64	30	39	64	77	86	139	62
72	L	L	L	W	L	58	20	40	59	81	W	L	L	W	L	73	18	45	58	77	131	138	38
73	W	W	L	L	L	64	24	41	53	86	W	W	L	L	L	57	22	44	60	76	121	130	46
74	L	W	W	W	L	55	24	43	51	86	L	W	W	W	W	61	22	41	64	75	116	126	46
75	W	L	L	L	L	65	20	40	56	84	W	W	L	L	L	39	18	47	57	76	104	149	38
76	W	W	W	W	L	44	30	41	66	73	L	L	W	L	L	55	28	45	53	82	99	151	58
77	L	L	L	W	W	67	26	44	61	75	W	L	L	L	L	56	24	44	55	81	123	133	50
78	L	W	L	W	L	68	30	45	58	77	W	L	W	L	L	57	28	40	58	82	125	133	58
79	L	L	L	L	L	55	32	42	58	80	W	A	W	L	L	58	30	38	58	84	113	123	62
80	A	W	W	L	L	41	26	44	65	71	L	L	L	W	L	56	24	42	52	86	97	153	50
81	W	W	L	W	L	43	30	41	62	77	L	W	L	L	W	55	28	46	53	81	98	143	58
82	L	L	W	A	L	52	38	42	62	76	W	L	W	L	L	74	36	43	54	83	126	149	74
83	W	A	L	W	L	64	56	45	59	76	L	W	L	L	L	36	54	40	58	82	100	114	110
84	L	W	L	A	L	53	22	39	65	76	W	L	W	L	L	39	22	41	56	83	92	149	44
85	W	L	A	L	L	72	26	45	65	70	W	A	W	L	L	45	26	44	55	81	117	124	52
86	A	W	L	L	L	53	26	39	66	75	L	L	L	W	L	48	26	41	56	83	101	150	52
87	W	L	W	L	W	53	22	40	63	77	L	L	W	L	L	61	22	42	57	81	114	125	44
88	W	W	L	L	L	52	34	53	57	70	L	W	L	L	W	21	34	39	60	81	73	150	68
89	L	A	W	W	W	60	28	41	57	82	L	L	W	W	L	33	28	43	54	83	93	131	56
90	L	W	L	W	L	47	26	33	61	86	W	W	L	L	L	56	26	44	54	82	103	115	52
91	W	W	L	W	L	39	30	43	52	85	W	L	A	L	L	62	30	35	64	81	101	120	60
92	L	L	A	A	L	57	32	43	66	71	L	A	L	W	L	73	32	37	63	80	130	140	64
93	W	L	L	W	L	65	26	39	60	81	L	W	W	L	L	47	26	48	51	81	112	120	52
94	W	W	L	L	L	56	30	44	63	73	W	L	L	L	W	65	30	47	53	80	121	130	60
95	L	L	W	W	L	59	30	40	56	84	L	W	L	W	L	57	30	52	49	79	116	125	60
96	A	W	L	L	L	37	28	39	57	84	L	L	L	L	L	58	28	41	58	81	95	105	56
97	L	W	W	L	L	46	28	52	54	74	W	W	L	W	L	54	28	38	63	79	100	120	56
98	L	L	L	W	L	44	31	44	65	71	W	L	L	L	W	84	31	41	60	79	128	140	62
99	A	W	W	W	L	45	31	47	46	87	L	L	W	L	L	24	31	44	55	81	69	108	62
100	W	A	L	L	L	59	28	50	60	70	W	L	L	L	L	25	28	41	58	81	84	148	56

DISCUSSION

In our study, the dermatoglyphic data was collected from 100 histologically confirmed breast cancer cases and 100 normal age matched subjects were taken as controls. It was found in our study that the total percentage of arches in cases was 2.9% whereas in controls it was 6%. The total percentage of whorls in cases was 36.1% whereas in control it was 32.1% and the total percentage of loops in cases was 61% whereas in controls it was 61.9%. In the study by Chintamani et al[11], they found similar differences between the cases and controls.

In this study , a statistical significance in the comparison of the loops of right index finger between cases and controls and also between the whorls of right ring finger between cases and controls were found with the p values being 0.028 and 0.048 respectively. (Table 2,chart 3)

It was also found that there was a statistical significance in the comparison of the whorls (p value -0.048) of left ring finger between the cases and controls. (Table 3,chart 4)

On quantitative analysis of the finger prints, the TFRC between cases and controls were evaluated using the t test and it was found to be

statistically significant in comparison of cases to controls. In the study N S Sridevi et al[52], they also found significant differences in TFRC values between cases and controls. The values are tabulated in table 5.

The mean values of AFRC values between cases and controls were also analyzed using the t test and a statistical difference was found. The study by Chintamani et al[11] found that the mean ridge count count in the right hand between cases and controls to be statistically significant, $p< 0.05$. The mean ridge count of left hand also showed significance in that mean ridge count in cases was lower than in controls.

The a-b ridge count of the cases and controls were tabulated in table 7, and a statistical difference was found between cases and controls on both right and left sides. In the study by N S Sridevi et al[52], they found statistical differences between cases and controls.

The atd, dat and adt angles are tabulated in table 8 for the right hand and in table 9 for left hand. In our study, statistical difference was found in adt angle on the right side with a p value of 0.026 and on the left side the p value was found to be 0.010. Chintamani et al[11,] did not include this aspect

in their study. NS Sridevi et al[52] also showed similar significance in their study.

CONCLUSION

In our study, the findings are:

Qualitative Parameters:

- In the analysis of qualitative patterns, the percentage of arches in all the fingers of the cases is 2.9%, and in that of controls, the percentage is 6%. The percentage of whorls in all the fingers of the cases is 36.1%, the percentage in controls being 32.1%. It was found that the percentage of loops in all the fingers of the cases is 61%, while that in controls it is 61.9%. From this I conclude that the percentage of arches is more in controls than in cases. And also, the percentage of whorls is more in cases than in controls accompanied with a negligible difference in the percentage of loops.
- A statistical significance was found between cases and controls in whorl pattern in ring finger of both right and left hands (p value = < 0.05) and also in the loop pattern of right index finger (p value = <0.05.

Quantitative Parameters:

- The mean value of TFRC in both hands of cases is 126.01 with a standard deviation of 18.763 and the total mean of TFRC in controls is 103.89 with a standard deviation of 17.754. This difference in mean value is found to be statistical increase in the mean value of cases with p value < 0.001.
- The mean value of AFRC in both hands of cases is 153.76 with a standard deviation of 14.714 and the total mean of AFRC in controls is 129.74 with a standard deviation of 14.021. This difference in mean value is found to be statistical increase in the mean value of cases with p value < 0.001.
- The mean value of a-b ridge count in both hands of cases is 65.36 with a standard deviation of 8.613 and the total mean of a-b ridge count in controls is 51.88 with a standard deviation of 12.581. This difference in mean value is found to be statistically increased in cases with p value < 0.001.
- The mean value of adt angle in right hand of cases is 78.28 with a standard deviation of 5.591 and the total mean of adt angle in right hand of controls is 80.07 with a standard

deviation of 5.732. This difference in mean value is found to be statistically decreased in cases with p value < 0.05 (0.026).

- The mean value of adt angle in left hand of cases is 78.19 with a standard deviation of 5.47 and the total mean of adt angle in right hand of controls is 80.19 with a standard deviation of 5.460. This difference in mean value is found to be statistically decreased in cases with p value < 0.05 (0.010).

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PATIENT'S INFORMATION SHEET

Title of Research Project: A Study on Dermatoglyphic patterns in women with Breast Cancer.

Name of the Investigator: Dr.

Aim of this research project - to study the palmar dermatoglyphic pattern in the patients of Breast cancer & compare it with the dermatoglyphic pattern of the non-affected general population.

Method used - 'Ink Method'.
Palmer & finger prints will be taken on white paper by ink method.
Biological samples are not required for this project.
Expected duration required to take palmer prints by this method is about 10-15 minutes.
By participating in the study there is no risk to the patients. All these records will be kept confidential.
The patient can withdraw from research at any time without penalty.

INFORMATION CONSENT FORM (ICF)
(CONFIDENTIAL)

Title of Research Project: A Study on Dermatoglyphic patterns in women with Breast Cancer.

I_____ resident of _____
_____ aged ____ years, excercising my free will/choice,without any pressure/lure of incentive in any form hereby give my consent.

I acknowledge the receipt of "Patient's Information Sheet" and also the doctors have informed me about this research project suitably & sufficiently to my satisfaction. I am ready do give my palmar & finger prints by using ink. I shall cooperate with doctors & paramedical staff on all participation in this study. I shall not be given any reimbursment or compensation. I have been informed of my right to opt out of this research project at any time without giving any reason for doing so.I hereby record my consent for participation in the research project.

1. _____ _____ _____ _____
Patient's Name Signature/Thumb Print Date Time

2. _____ _____ _____ _____
Attenders Name Sign Date Time

3. _____ _____ _____ _____
Investigator's Name Sign Date Time

PROFORMA

Name :

Age :

Sex:

Address :

Occupation :

Date:

OP/IP No.

Admitted for Complaints of :

Past History:

- Systemic Hypertension
- Diabetes mellitus
- Dyslipidemia
- CAD

Personal history :

- Smoking
- Alcohol

Family history :

Diagnosis :

LEGEND

Ws	-	Whorl Spiral
Wc	-	Whorl Concentric
Wtl	-	Twin Loop Whorl
Wlp	-	Lateral Pocket Whorl
Wcp	-	Central Pocket Whorl
D1	-	First Digit/ Thumb
D2	-	Second Digit/ Index Finger
D3	-	Third Digit/ Middle Finger
D4	-	Fourth Digit/ Ring Finger
D5	-	Fifth Digit/ Little Finger
t	-	Triradius near wrist crease
t"	-	Triradius near centre of palm
t'	-	Triradius between t and t
AFRC	-	Absolute Finger Ridge Count
TFRC	-	Total Finger Ridge Count
ABRC	-	a-b Ridge Count
Hypo	-	Hypothenar
Th	-	Thenar
ID1	-	First Inter-digital area

ID2	-	Second Inter-digital area
ID3	-	Third Inter-digital area
ID4	-	Fourth Inter-digital area
X	-	Mean
SD	-	Standard Deviation
SE-M	-	Standard Error of Mean